The Internationalization Process of Firms: from Exports to FDI*

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Abstract

We examine how uncertainty affects the dynamics of firms' internationalization choices. We describe a model in which firms decide whether to serve a foreign market, and whether to do so through exports or foreign direct investment (FDI). Firms are uncertain about their ability to earn profits in the foreign market, which they can only discover by operating there. We derive conditions under which firms will follow a gradual internationalization process, "testing" the foreign market via exports before investing in local production facilities. To assess the model's predictions, we use detailed firm-level information about exports and FDI in individual destinations markets, for all companies registered in Belgium since the early 1990s. We find that a firm's export experience in a foreign country plays a crucial role in its decision to start investing there, and the effect is stronger in the face of higher uncertainty. Our analysis suggests that exports and FDI, although substitutes from a static perspective, may be complements over time, since the knowledge acquired through export experience can lead firms to invest abroad. Trade liberalization may thus foster FDI, by lowering the costs of export experimentation.

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1 Introduction

In recent decades, more and more companies have started to operate internationally, selling their goods and services to foreign customers through exports or local subsidiary sales. When deciding whether and how to serve new markets, firms are often faced with high levels of uncertainty: on the supply side, they may not be aware of the legal requirements and local regulations for selling their goods in particular markets; on the demand side, they may be uncertain about preferences of foreign consumers and the adequacy of their products to local tastes.

In this paper, we examine how uncertainty about foreign market conditions affects firms dynamic choices over exports and foreign direct investment (FDI). We focus on "horizontal" FDI, which refers to the establishment of foreign production facilities with the purpose of serving the local market.[1] To this end, we develop a tractable model of firms' internationalization decisions under uncertainty, derive empirical predictions from it, and take them to the data. Our analysis shows that the need to acquire market-specific knowledge can lead firms to follow a gradual internationalization process, serving a market via exports before establishing foreign production facilities.

Our analysis builds on the vast literature on the "proximity-concentration" trade-off, which examines firms' decisions on whether to serve a foreign market, and whether to do so through exports or local subsidiary sales (e.g., Markusen, 1984; Brainard, 1997; Helpman *et al.*, 2004). The key novelty of our paper is the emphasis on market uncertainty and experimentation. In the spirit of Jovanovich (1982), we describe a simple model in which firms are uncertain about their ability to earn profits in a foreign market, and can only discover it by actually serving it. In this setting, we derive conditions under which firms will first "test" the foreign market by exporting small amounts; following this initial trial phase, they will either exit, expand export volumes, or engage in FDI. The intuition for this result is simple: in the face of market uncertainty, firms prefer to "experiment" through exports, which involve lower fixed costs and thus less commitment to a market than FDI.[2]

[1] Since our goal is to examine firms' choices on how to serve customers in a foreign market, we do not consider "vertical" FDI, which involves the fragmentation of the production process across different countries to reduce costs, and "export-platform" FDI, whereby firms establish foreign affiliates in one country to serve neighboring countries. See Hanson *et al.* (2005) and Ekholm *et al.* (2007) for studies on vertical and export-platform FDI. In their review of the empirical literature on FDI, Markusen and Maskus (2003) and Blonigen (2005) conclude that most FDI is horizontal in nature. Indeed, foreign affiliates worldwide sell most of of their products locally. For example, over the period 2005-2010, less than 19 percent of affiliate sales were sold outside of the country of production (UNCTAD, 2011).

[2] Our theoretical analysis formalizes the ideas of a vast literature in international business studies, which argues that the need to acquire market specific knowledge leads firms to follow a process of gradual involvement in foreign markets. As stressed by one of the seminal papers in this literature,

To evaluate the predictions of our model, we employ firm-level data from the National Bank of Belgium (NBB), which provides detailed information on exports and FDI in individual countries for all companies registered in Belgium since the early 1990's. We investigate the dynamics of firms' internationalization choices, focusing on destinations outside the European Single Market, in which Belgian firms are more likely to face uncertain supply and demand conditions.

The results of our empirical analysis support the model's predictions, providing systematic evidence for firms' gradual involvement in foreign markets. First, we show that the overwhelming majority of firms that start investing in a foreign country have previously been exporting to it. This suggests that firms start serving foreign markets via exports. Second, most new exporters sell small amounts and disappear from export markets in the following period; export volumes and survival probability increase significantly in the following years. These findings suggest a process of "trials and errors", in which firms initially test foreign markets to find out whether they can make profits serving them. Finally, we show that a firm's export experience in a foreign country crucially affects its decision to start investing there, and the effect is stronger when supply and demand conditions are more uncertain.

Our analysis shows that firms' export and FDI decisions must be understood as part of an a broader dynamic strategy to serve foreign markets in the face of uncertainty. We show that, even when exports and FDI represent alternative ways of serving a foreign market – and are thus substitutes from a static perspective – they may be *complements over time* – since the knowledge acquired through export experience can lead firms to invest abroad.

In standard models of the proximity-concentration trade-off that abstract from market uncertainty, FDI is "tariff-jumping" and a fall in trade costs leads firms to substitute affiliate production for exports. Trade liberalization should thus decrease firms' incentives to establish production facilities in foreign countries. Contrary to this prediction, our analysis suggests that trade liberalization may actually foster FDI, by lowering the costs of export experimentation. This may partly explain why many studies of FDI determinants fail to find evidence for a positive effect of trade protection (e.g., Bloningen, 1997).

The remainder of this paper is organized as follows. Section 2 reviews different strands of literature related to our analysis. Section 3 presents the theoretical model of

firms are often uncertain about "characteristics of the specific national market – its business climate, cultural patterns, structure of the market system, and, most importantly characteristics of the individual customer" (Johanson and Vahlne, 1977).

firms' dynamic internationalization choices under uncertainty. Section 4 describes the datasets used in our empirical analysis. Section 5 provides descriptive statistics about the foreign activities of Belgian firms. Section 6 presents our empirical methodology and results. Section 7 concludes.

2 Related literature

Our paper contributes to the vast literature on the "proximity-concentration" tradeoff, which examines firms' decision on whether to serve a foreign market, and whether to do so through exports or horizontal FDI. These modes of market access have different relative costs: exporting involves lower fixed costs, while FDI involves lower variable costs. The key prediction of traditional models of the proximity-concentration tradeoff is that firms will invest abroad when the gains from avoiding trade costs outweigh the costs of maintaining capacity in multiple markets (e.g., Markusen, 1984; Horstmann and Markusen, 1992; Brainard, 1997; Markusen and Venables, 2000). Our paper shows that, when uncertain about their profitability in a foreign market, firms may *experiment* by serving the market via exports – the mode characterized by lower fixed costs – before switching to FDI.[3]

Helpman *et al.* (2004) introduce firm heterogeneity as in Melitz (2003) into a simple model of the proximity-concentration tradeoff and show that the higher fixed costs of FDI give rise to selection effects: the most productive firms engage in FDI, the less productive ones will export, and the least productive ones serve only the home market. Using data on exports and FDI sales of US firms in 38 countries and 52 industries, they provide cross-sectional evidence supporting this prediction. The paper by Helpman *et al.* (2004) emphasizes the importance of productivity differences in explaining *static* exports and FDI choices of *different firms* within sectors. Our paper focuses instead on the *dynamic* choices of *individual firms*, highlighting the importance of market uncertainty and learning.[4]

One of the only papers to study the dynamics of firms' internationalization choices is Rob and Vettas (2003). They describe an infinite horizon model in which a multinational

[3]Horstmann and Markusen (1996) develop a theoretical model of multinationals' decisions when foreign market conditions are uncertain. Rather than on the choice between exports and FDI, their analysis focuses on the choice between serving a foreign market via FDI or through a contractual arrangement with a local agent who has superior information about the market characteristics.

[4]A recent paper by Ramondo *et al.* (2010) introduces country-specific productivity shocks in a static model of the proximity-concentration tradeoff with heterogeneous firms. Their analysis does not examine firms' dynamics and experimentation, focusing instead on the relationship between cross-country differences in output fluctuations and cross-country patterns of exports and affiliate sales.

firm can serve a foreign market by exporting its product, creating productive capacity via horizontal FDI, or a combination of the two. For every unit sold abroad through FDI, the firm has to install capacity and investment in capacity is irreversible. Foreign demand grows stochastically over time: in each period, it either continues to grow or stops growing forever. In this setting, they show that uncertainty can give rise to a process of gradual involvement in foreign markets, in which firms export before setting up foreign subsidiaries.[5] Our paper differs from Rob and Vettas (2003) in two dimensions. First, our simple theoretical model allows to capture both demand and supply uncertainty in foreign markets, while they only focus on the role of demand uncertainty. Second, we bring the predictions of our model to the data, while their analysis is only theoretical in nature.

The idea that uncertainty can lead firms to delay investment is central to real options theory. This suggests that, if investments are irreversible and market conditions are uncertain, firms may prefer to minimize current investments but secure an option to invest at a later time (e.g., McDonald and Siegel, 1986; Dixit and Pindyck,1994, Guiso and Parigi, 1999). Our paper shows that, when faced with the choice on how to serve foreign markets, firms may optimally choose to export first, waiting to invest until they learn about foreign demand and supply conditions.

The difficulty for firms to acquire information about foreign markets has long been emphasized by the international business literature. Starting from Johanson and Vahlne (1977), many studies argue that market-specific knowledge can only be gained by operating abroad, is often tacit in nature, highly dependent on individuals, and thus difficult to transfer to other individuals or other contexts. To acquire such knowledge, firms serve foreign markets via exports first and eventually, in some cases, establish foreign production subsidiaries.[6] Our paper develops a simple dynamic model to formalize these ideas and provides systematic evidence for firms' gradual involvement in foreign markets.[7]

[5]The multinational chooses at each point in time an optimal combination of exports and FDI. The latter entails the risk of creating under-utilized capacity in the case that the market turns out to be small, so the firm always starts with exports and switches to FDI if demand is large enough. Under certain conditions, it may use a combination of exports (to explore uncertain demand) and FDI (to satisfy proven demand).

[6]This literature also suggests that firms may first engage in joint ventures with local firms, which provide the right (but not the obligation) for future investment (e.g., Chi, 2000) and can help to obtain knowledge about local market conditions (Chi and McGuire, 1996). Once uncertainties have been reduced, firms involved in joint ventures may choose to purchase more equity in the venture, sell their equity share, or dissolve the venture (e.g., Kumar, 2005).

[7]The international business literature has relied on case studies or surveys to examine firms' internationalization choices. For example, the seminal contribution by Johanson and Vahlne (1977) is based on case studies of few Swedish firms, while the more recent paper by Brouthers *et al.* (2008) relies on a survey of Dutch and Greek firms.

Finally, our paper is related to the recent literature on firms' export dynamics (e.g., Eaton *et al.* (2008); Albornoz *et al.* (2010), and Morales *et al.* (2011), among many others). This identifies new "stylized facts" about exporting firms: many new exporters do not survive into the next year; they begin by exporting small amounts but – conditional on survival – they grow rapidly and account for a substantial proportion of export growth.[8] Theoretical models seeking to account for firms' export dynamics emphasize learning about foreign markets and trade relationships. [9] Most related to our analysis is the recent paper by Albornoz *et al.* (2010). They develop a simple model in which firms discover their profitability in foreign markets by exporting to them, examining firms' export dynamics *across different* destinations ("sequential exporting"). Our focus is instead on how learning and experimentation *within* a given destination can lead firms to switch from exports to FDI ("internationalization process"). To the best of our knowledge, none of the recent studies on export dynamics has examined the relationship between firms' exports and FDI choices, and whether export experience leads firms to establish foreign subsidiaries.

3 The model

3.1 Setup

We describe a simple model in which a representative risk-neutral firm producing good k in its domestic market must decide whether or not to serve foreign market i, and whether to do that via exports or horizontal FDI.[10]

Variable costs comprise a unit cost of production, which for simplicity is normalized to zero, and a unit cost c_{ik} for selling to consumers in country i (e.g., capturing distribution

[8]See, for example, Eaton *et al.* (2008) for Columbian firms, Aeberhardt *et al.* (2009) for French firms, Lawless (2009) for Irish firms, and Albornoz *et al.* (2010) for Argentinian firms.

[9]One of the earlier papers on trade dynamics and incomplete information is Rauch and Watson (2003). They describe a model with costly search in which a buyer from a developed country is uncertain about whether exporters from developing countries are able to fill a large scale order. In this setting, trade relations start small because importers "test" exporters by placing small orders that reveal their type. Eaton *et al.* (2010) develop a model where producers learn about the appeal of their products by devoting resources to finding consumers and by observing the experiences of competitors. Freund and Pierola (2010) focus on the incentives of firms to develop new export products in the face of uncertainty about export costs. Their analysis of the frequency of entry and exit from foreign markets for Peruvian firms in the non-traditional agricultural sector in Peru shows a process of "trial and errors". Arkolakis (2010) builds a model in which firms face convex costs of advertising and are thus forced to slowly build market share in export markets.

[10]In our theoretical analysis, we abstract from firm heterogeneity, to focus on the role of uncertainty and knowledge acquisition in foreign markets. In our empirical analysis, we will control for productivity differences across firms, in line with Helpman *et al.* (2004) and Head and Ries (2003), among others.

costs in the foreign market). If the firm serves the foreign marker via exports, it bears a unit trade cost equal to τ_{ik} (reflecting both transport costs and barriers to trade) and incurs a one-time fixed cost equal to F_{ik}^E (e.g., capturing the costs of dealing with customs procedures). If instead the firm engages in FDI, setting up a foreign production subsidiary, it avoids trade costs, but incurs a one-time fixed cost $F_{ik}^I > F_{ik}^E$. Both fixed costs are assumed to be irreversible.[11]

The firm faces a linear demand in the foreign market:

$$q_{ik}(p_{ik}) = a_{ik} - p_{ik}, \tag{1}$$

where q_{ik} and p_{ik} denote the output sold in the foreign market and the corresponding price. The main feature of our model is that firms face uncertainty about foreign supply and demand conditions, so they do not know how profitable it will be for them to serve the foreign market. We allow for uncertainty in both foreign demand and supply conditions: firms do not initially know the willingness of foreign consumers to pay for their product (captured by the parameter a_{ik}), nor their unit cost of selling abroad (captured by c_{ik}). We denote profitability in the foreign market by

$$\mu_{ik} \equiv a_{ik} - c_{ik}. \tag{2}$$

Before serving the foreign market, domestic firms know the distribution of profitability in a foreign market. However, individual firms do not know what their true profitability is and can only learn this as they operate in the foreign market. We assume that μ_{ik} is a random variable with a continuous cumulative distribution function $G(.)$ on the support $[\underline{\mu}_{ik}, \overline{\mu}_{ik}]$. $\overline{\mu}_{ik}$ is realized with the highest possible demand intercept ($\overline{a}_{ik}$) and the lowest possible unit cost ($\underline{c}_{ik}$); $\underline{\mu}_{ik}$ is realized instead under the opposite extreme scenario, i.e., with $\underline{a}_{ik}$ and $\overline{c}_{ik}$. We denote with $E\mu_{ik}$ the expected value of profitability in market i for a domestic firm selling good k.

To simplify notation, in what follows, we drop country and sector subscripts, with the understanding that country variables refer to foreign market i and sectoral variables refer to industry k. The minimum level of profitability that guarantees that a firm earns

[11] In what follows, we will assume that the fixed cost of setting up a foreign subsidiary in a given market is independent of whether a firm has already exported to that market. At the end of the section, we discuss the implications of relaxing this assumption.

positive profits by entering the foreign market via exports is[12]

$$\mu^E \equiv (F^E)^{1/2} + \frac{\tau}{2}. \tag{3}$$

We assume the following:

Assumption 1 $\underline{\mu} < \tau$ *and* $\overline{\mu} > \mu^E$.

The restriction $\underline{\mu} < \tau$ ensures that, even if there are no fixed costs associated with exports ($F^E = 0$), exporting is not always profitable; $\overline{\mu} > \mu^E$ guarantees that exporting can be profitable under some realizations of μ.

Opening a foreign subsidiary yields positive profits only if μ exceeds the following threshold:[13]

$$\mu^I \equiv (F^I)^{1/2}. \tag{4}$$

To make sure that FDI is profitable for some realizations of μ, we impose the following restriction:

Assumption 2 $\underline{\mu} < \mu^I < \overline{\mu}$.

Finally, for the choice between export and horizontal FDI to be interesting, firms must face a proximity-concentration tradeoff. We thus assume the following:

Assumption 3 $\mu^E < \mu^I$.

This guarantees that the fixed costs of setting up a foreign subsidiary are large enough that FDI does not always dominate exports.

[12]To verify this, notice that profits from entering the foreign market via exports can be written as $\Pi^E = (\mu - q^E - \tau)q^E - F^E$. Maximizing Π^E with respect to q^E yields optimal export sales, $\hat{q}^E = \frac{\mu-\tau}{2}$, which are positive for $\mu > \tau$. Export profits can then be rewritten as

$$\Pi^E = \left(\frac{\mu - \tau}{2}\right)^2 - F^E.$$

It is straightforward to verify that this expression is positive $\mu > (F^E)^{1/2} + \frac{\tau}{2}$.

[13]Profits from FDI entry can be written as $\Pi^I = (\mu - q^I)q^I - F^I$. Maximizing this function with respect to q^I yields optimal foreign affiliate sales, $\hat{q}^I = \frac{\mu}{2}$. Profits from establishing a foreign affiliate can then be written as

$$\Pi^I = \left(\frac{\mu}{2}\right)^2 - F^I,$$

which is positive for $\mu > (F^I)^{1/2}$.

3.2 Timing and entry strategies

For simplicity, and without loss of generality, we assume that the firm does not discount the future. The timing of decisions is as follows:

> $t = 1$: the firm chooses between exporting to the foreign market, setting up a foreign subsidiary, or not entering the market at all. If the firm decides to enter via exports (FDI), it pays the per-destination fixed cost F^E (F^I) and chooses how much to sell in that period. At the end of this period, if the firm has sold a positive amount, it infers μ from its profit.
>
> $t = 2$: If the firm has not entered the foreign market at $t = 1$, it decides whether or not to do so. If the firm has entered at $t = 1$, it decides whether to exit the foreign market, serve it under the same mode, or switch mode.

The setup is similar to Jovanovic (1982)'s model of firm dynamics, in which individuals are uncertain about their entrepreneurial ability and can only discover it through the process of starting a new firm. In our model, firms can only find out their profitability in a foreign market if they actually operate there, either through exports or through FDI. Firms choose between three possible entry strategies:

a) No entry in the foreign market at $t = 1$.

b) Entry via exports at $t = 1$: in the first period, the firm pays the fixed cost F^E, exports to the foreign market and discovers its profitability; in the second period, it decides whether to continue serving the foreign market through exports, switch to FDI, or exit;

c) Entry via FDI at $t = 1$: in the first period, the firm pays the fixed cost F^I and serves the foreign market through its foreign subsidiary; in the second period, the firm decides whether to continue serving the foreign market through FDI, switch to exports, or exit;

In what follows, we solve for the firm's optimal decisions by backward induction.

3.3 Period $t = 2$

a) No entry at $t = 1$

In this case, the firm does not enter the foreign market in the second period, earning zero profits.

b) Entry via exports at $t = 1$

Consider a firm that has exported to the foreign market in the first period and discovered its profitability μ. In the second period, it must decide whether to continue exporting, open a foreign subsidiary, or exit the foreign market. If the firm continues to export, its second-period profits are given by

$$\pi^{EE}(\tau) \equiv (\mu - \tau - q^{EE})q^{EE}. \tag{5}$$

The firm will choose q^{EE} so as to maximize (5), which yields second-period export sales equal to

$$\hat{q}^{EE}(\tau) = K_{\{\mu>\tau\}}\frac{\mu - \tau}{2}, \tag{6}$$

where $K_{\{.\}}$ is an indicator variable, here denoting whether $\mu > \tau$. Notice that for lower levels of realized profitability (i.e., $\mu \leq \tau$), export sales will be equal to zero. Plugging (6) into (5), we can rewrite second-period export profits as

$$\pi^{EE}(\tau) = K_{\{\mu>\tau\}}\Big(\frac{\mu - \tau}{2}\Big)^2. \tag{7}$$

Alternatively, after discovering its profitability in the foreign market, the firm can decide to switch to FDI. In this case, its second-period profit will be given by

$$\pi^{EI}(F^I) \equiv (\mu - q^{EI})q^{EI} - F^I. \tag{8}$$

Notice that second-period FDI profits are positive only if μ exceeds the threshold μ^I defined in equation (4). Maximization of (8) yields the optimal quantity decision

$$\hat{q}^{EI} = K_{\{\mu>\mu^I\}}\frac{\mu}{2}. \tag{9}$$

The profits obtained from establishing a production facility at $t = 2$ are thus equal to

$$\pi^{EI}(F^I) = K_{\{\mu>\mu^I\}}\Big(\frac{\mu^2}{4} - F^I\Big). \tag{10}$$

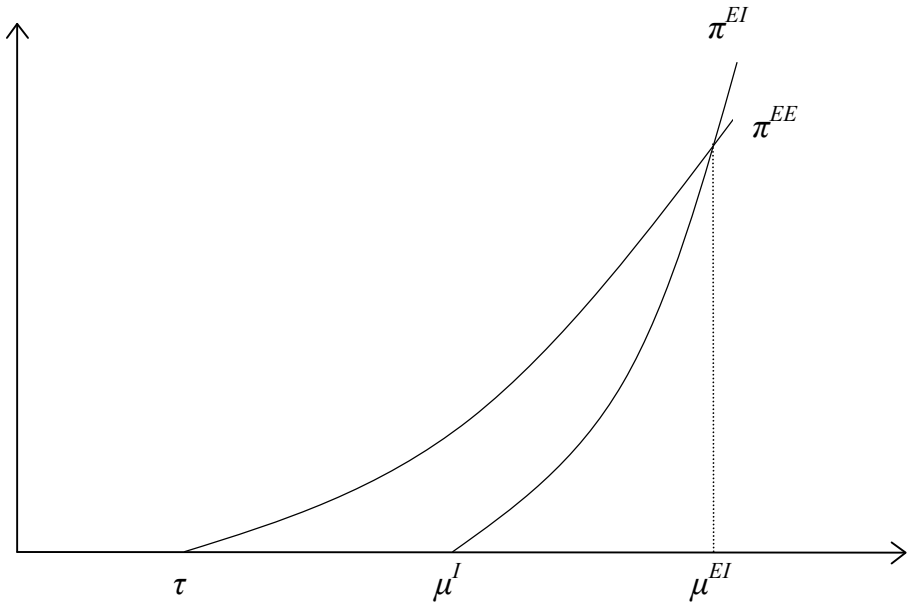
Comparing (10) with (7), we can derive the profitability threshold above which a firm that has exported to the foreign market in the first period will switch to FDI in the

second period:

$$\mu^{EI} \equiv \frac{2F^I}{\tau} + \frac{\tau}{2}. \tag{11}$$

Figure 1 illustrates second-period profits for a firm that has exported to the foreign market in the first period. The firm's decision on whether to switch from export to FDI in the second period depends on its profitability in the foreign market, discovered at the end of the first period. If μ is below the trade cost τ, serving the foreign market is not profitable and the firm will exit. If profitability lies in the range between τ and μ^{EI}, the firm will continue to serve the foreign market via exports. If instead μ is higher than μ^{EI}, the firm will open a foreign production subsidiary.

Figure 1: Export and FDI profits at $t = 2$ following entry via exports at $t = 1$



Ex ante, the firm anticipates that, after exporting a positive amount in the first period, it may be forced to exit the foreign market in the second period, if it discovers that its profitability μ is below τ. If instead $\tau < \mu < \mu^{EI}$, the firms will continue to export. Finally, if the firm discovers that its profitability exceeds μ^{EI}, it will establish a foreign production subsidiary . We can thus state the following:

Proposition 1 *A firm entering the foreign market via exports at $t = 1$, will exit the market at $t = 2$ with probability $G(\tau)$, will continue to export with probability $G(\mu^{EI}) -$*

$G(\tau)$, or switch to FDI with probability $1 - G(\mu^{EI})$.

A decrease in the fixed costs of establishing a foreign production plant and an increase in trade costs make a switch from exports to FDI more appealing. To verify this, notice that the threshold μ^{EI} increases with the fixed costs of setting up a foreign subsidiary

$$\frac{\partial \mu^{EI}}{\partial F^I} = \frac{2}{\tau} > 0 \tag{12}$$

and decreases with the extend of the trade costs[14]

$$\frac{\partial \mu^{EI}}{\partial \tau} = \frac{1}{2} - \frac{2F^I}{\tau^2} < 0. \tag{13}$$

From an ex-ante perspective (i.e., evaluated at $t = 0$), second-period profits of a firm exporting to the foreign market in the first period can be written as

$$V^E(\tau, F^I) = \int_{\tau}^{\mu^{EI}} \left(\frac{\mu - \tau}{2}\right)^2 dG(\mu) + \int_{\mu^{EI}}^{\overline{\mu}} \left(\frac{\mu^2}{4} - F^I\right) dG(\mu). \tag{14}$$

Equation (14) captures the option value of serving the foreign market in the second period, once the firm has discovered its profitability. The term $\int_{\tau}^{\mu^{EI}} \left(\frac{\mu-\tau}{2}\right)^2 dG(\mu)$ reflects the option value of continuing to export, while the term $\int_{\mu^{EI}}^{\overline{\mu}} \left(\frac{\mu^2}{4} - F^I\right) dG(\mu)$ captures the option value of switching to FDI.

c) Entry via FDI at $t = 1$

Finally, consider the case in which the firm establishes a production facility in the foreign market at $t = 1$, paying the fixed costs F^I. In this case, second-period FDI profits are equal to $\pi^{II} = (\mu - q^{II})q^{II}$. Plugging in optimal subsidiary sales, this expression can be rewritten as

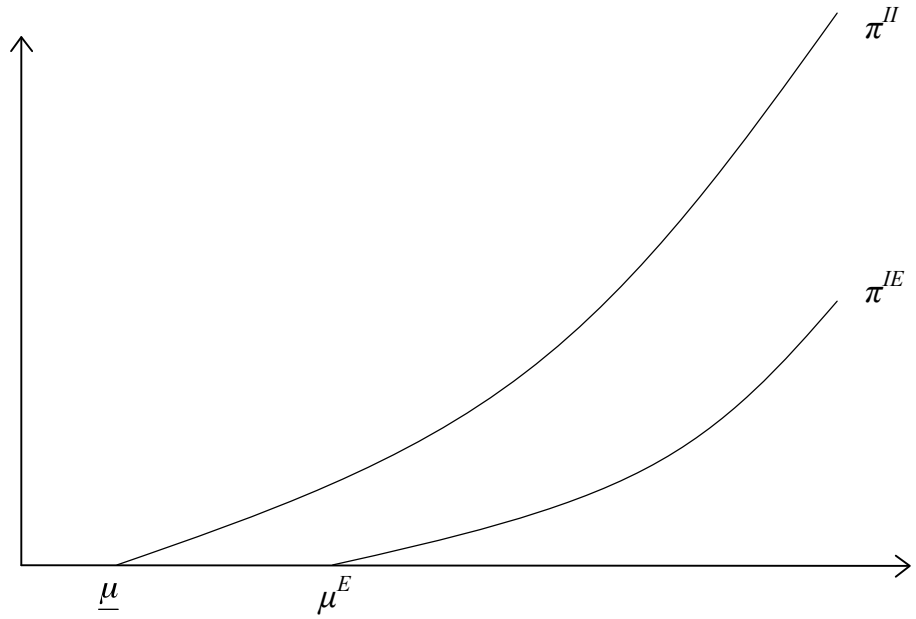
$$\pi^{II} = \frac{\mu^2}{4}. \tag{15}$$

Notice that second-period FDI profits can never be negative, implying that exiting the foreign market at $t = 2$ is a dominated strategy.

Exporting in the second period, after having opened a subsidiary in the first, is also a dominated strategy. To verify this, notice that a firm switching to exports at $t = 2$

[14]To verify this, notice that $F^I > \frac{1}{4}(2(F^E)^{1/2} + \tau)^2$ by Assumption 3. This implies that $\frac{2F^I}{\tau^2} > \frac{1}{2}$ and thus $\frac{\partial \mu^{EI}}{\partial \tau} < 0$.

Figure 2: Export and FDI profits at $t = 2$ following entry via FDI at $t = 1$



will earn profits equal to

$$\pi^{IE}(\tau, F^E) = K_{\{\mu > \mu^E\}}\left(\left(\frac{\mu - \tau}{2}\right)^2 - F^E\right). \tag{16}$$

Comparing (16) with (15), it is straightforward to verify that, for any level of profitability μ, $\Pi^{II} > \Pi^{IE}(\tau, F^E)$. Thus continuing to serve the foreign market through foreign subsidiary sales is always preferable to the option of switching to exports. The intuition for this result is simple: once a firm has paid the fixed costs F^I, starting to serve the foreign market via exports would imply paying additional fixed costs F^E and trade costs τ. We can thus state the following:

Proposition 2 *A firm entering the foreign market via FDI at $t = 1$ will never exit or switch to exports at $t = 2$.*

Having derived the firm's expected profits in the second period, we can now move to the analysis of its entry strategies in the first period.

3.4 Period $t = 1$

a) No entry at $t = 1$

The firm does not enter the foreign market, earning zero profits.

b) Entry via exports at $t = 1$

From an ex-ante perspective (at $t = 0$, before discovering its profitability in the foreign market), the firm will choose q^E to maximize

$$\begin{aligned}\omega^E(\tau, F^E, F^I, q^E) \equiv & \int_{\underline{\mu}}^{\overline{\mu}} (\mu - \tau - q^E) q^E dG(\mu) - F^E \\ & + K_{\{q^E>0\}} \Big\{ \int_{\tau}^{\mu^{EI}} \Big(\frac{\mu - \tau}{2}\Big)^2 dG(\mu) + \int_{\mu^{EI}}^{\overline{\mu}} \Big(\frac{\mu^2}{4} - F^I\Big) dG(\mu) \Big\}. \end{aligned} \tag{17}$$

The first line of (17) captures the expected operational export profits in the first period. The second line represents expected second-period profits, V^E in equation 14.

The choice of first-period export volumes depends on the expected profitability in the foreign market, $E\mu$. Consider first a scenario in which $E\mu > \mu^E \equiv 2(F^E)^{1/2} + \tau$. In this case, the firm expects to make positive profits in the first period and will export $\hat{q}^E = \frac{\mu - \tau}{2}$. Consider next the limit-case scenario in which $E\mu = \mu^E$. In this case, the firm expects to make zero profits in the first period. Absent uncertainty, it would thus be indifferent about entering the foreign market or not. In the presence of uncertainty, the firm will instead choose to "test" the foreign market, exporting an amount $\hat{q}^E = \frac{\mu - \tau}{2}$ to secure the possibility of making profits in the second period. In a scenario in which $\tau \leq E\mu < \mu^E$, expected first-period profits are negative. However, if $\frac{E\mu - \tau}{2} - F^E + V^E \geq 0$, the firm will still choose to export $\hat{q}^E = \frac{\mu - \tau}{2}$. Finally, consider a scenario in which $E\mu < \tau$. Again, expected first-period profits will be negative, but the firm may still be willing to "test" the foreign market, exporting an arbitrarily small amount $\epsilon > 0$, as long as $(E\mu - \tau - \epsilon)\epsilon - F^E V^E \geq 0$. Expected profits from entering the foreign market at $t = 1$ via exports can thus be rewritten as

$$\begin{aligned}\Omega^E(\tau, F^I, F^E, q^E) \equiv & \int_{\tau}^{\overline{\mu}} \Big(\frac{\mu - \tau}{2}\Big)^2 dG(\mu) - F^E \\ & + K_{\{q^E>0\}} \Big\{ \int_{\tau}^{\mu^{EI}} \Big(\frac{\mu - \tau}{2}\Big)^2 dG(\mu) + \int_{\mu^{EI}}^{\overline{\mu}} \Big(\frac{\mu^2}{4} - F^I\Big) dG(\mu) \Big\}. \end{aligned} \tag{18}$$

c) Entry via FDI at $t = 1$

A firm setting up a foreign subsidiary at $t = 1$ chooses foreign sales q^I to maximize

$$\omega^I(F^I, q^I) \equiv \int_{\underline{\mu}}^{\overline{\mu}} (\mu - q^I) q^I dG(\mu) - F^I + K_{\{q^I>0\}} \int_{\underline{\mu}}^{\overline{\mu}} \frac{\mu^2}{4} \tag{19}$$

The first two terms capture the firm's expected profits from FDI at $t = 1$, while the second term denotes expected profits at $t = 2$. Notice that expected first-period profits are only positive if $E\mu$ exceeds the threshold μ^I defined in equation (4). However, even if $E\mu < \mu^I$, the firm may be willing to engage in FDI and sell an arbitrarily small amount $\epsilon > 0$ at $t = 1$. For this to be the case, the following must be true:

$$(E\mu - \epsilon)\epsilon - F^I + \int_{\underline{\mu}}^{\overline{\mu}} \frac{E\mu^2}{4} \geq 0. \tag{20}$$

We can thus rewrite the firm's expected profits from entering the foreign market via FDI as follows:

$$\Omega^I(F^I, q^I) \equiv \int_{\mu^I}^{\overline{\mu}} \frac{(\mu)^2}{4} dG(\mu) - F^I + K_{\{q^I>0\}} \int_{\underline{\mu}}^{\overline{\mu}} \frac{\mu^2}{4} dG(\mu). \tag{21}$$

3.5 Entry strategy

In our analysis above, we have derived export and FDI profits from an ex ante perspective, i.e., evaluated at $t = 0$, when the firm does not yet know its profitability. This allows us to understand how uncertainty about profitability in the foreign market affects the firm's decision to enter via exports or FDI.

We have established that a firm entering the foreign market via exports may continue to serve the foreign market via export, switch to FDI, or exit, depending on its profitability in the foreign market (Proposition 1). In contrast, firms that establish a foreign subsidiary at $t = 1$ will always continue serving the foreign market via FDI at $t = 2$ (Proposition 2). Uncertainty can thus lead firms to switch from exports to FDI, but not vice versa.

The following result characterizes the conditions under which a firm will follow a gradual "internationalization process":

Proposition 3 *If $\Omega^E(\tau, F^I, F^E) > 0$ and $\Omega^E(\tau, F^I, F^E) > \Omega^I(F^I)$, the firm will enter the foreign market via exports at $t = 1$, switching to FDI at $t = 2$ with probability $1 - G(\mu^{EI})$.*

We can show that, when "experimentation" matters, the firm will always follow this process of gradual involvement in the foreign market. To verify this, consider again a scenario in which $E\mu = \mu^E$. In this case, the firm anticipates that, if it enters via exports, it will make zero profits in the first period, but positive profits in the second:

$$\Omega^E(\tau, F^I, F^E) = \int_{\tau}^{\mu^{EI}} \left(\frac{\mu - \tau}{2}\right)^2 dG(\mu) \int_{\mu^{EI}}^{\overline{\mu}} \left(\frac{\mu^2}{4} - F^I\right) dG(\mu) > 0. \tag{22}$$

In contrast, when $E\mu = \mu^E$, expected profits from FDI entry are negative:[15]

$$\Omega^I(F^I) = \frac{E\mu^2}{4} = \frac{((F^E)^{1/2} + \frac{\tau}{2})^2}{4} - F^I < 0. \tag{23}$$

Thus, uncertainty about foreign demand and supply conditions can lead a firm to "experiment" by exporting small amounts first. Following this "trial" phase, the firm will either exit, expand its export volumes, or switch to FDI.

In our model, exports and horizontal FDI are substitutes from a static perspective, since they represent alternative ways through which firms serve foreign markets, but may be *dynamic complements*, since the market-specific knowledge acquired through exports experience can lead firms to set up foreign production plants.

Contrary to the predictions of standard models of the proximity concentration trade-off that abstract from uncertainty, our analysis also implies that trade liberalization may foster FDI, by lowering the cost of export experimentation. To verify this, consider a scenario in which trade costs are initially such that $E\mu > \tau > E\mu - 2(F^E)^{1/2}$. In this case, first-period expected profits from entering the foreign market via exports are negative. If the first-period loss exceeds the option value of serving the foreign market in the second period, captured by V^E in equation (14), the firm will choose not serve the foreign market. Now assume that trade costs are reduced to $\tau = E\mu - 2(F^E)^{1/2}$. In this case, the firm will expect to make zero profits by entering the foreign market at $t = 1$, but will be willing to export a small amount equal to $\frac{E\mu - \tau}{2}$ to secure the possibility of positive profits in the future. In turn, export experimentation will lead firms to switch to FDI in at $t = 2$ with a probability $1 - G(\mu^{EI})$. We can thus state the following:

Proposition 4 *In the presence of uncertainty, trade liberalization can foster FDI, by lowering the cost of experimenting in foreign markets.*

In our analysis above, we have assumed that the fixed cost of establishing a production facility in a foreign market is independent of whether the firm has previously

[15]This follows from Assumption 3.

exported to that market. This will be the case if F^E includes only costs that are specific to exporting (e.g., dealing with customs procedures) and F^I captures only FDI costs (e.g., building a plant in the foreign country). However, serving a foreign market may also involve fixed costs that are common to both exports and FDI (e.g., establishing distribution channels, designing a marketing strategy, dealing with foreign bureaucracies). In this case, the fixed costs of exports and FDI could be rewritten as $F^E = K + f^E$ and $F^I = K + f^I$, respectively, with $f^I > f^E$. Notice that the main results of our analysis (Propositions 4- 3) would continue to hold under this alternative formulation of the fixed costs. However, a switch from exports to FDI would be more likely.[16]

To summarize, our theoretical model gives rise to the following empirical predictions:

1. Uncertainty can lead firms to "test" foreign markets via exports.

2. Following an initial "trial phase", firms will either exit, expand export volumes, or engage in FDI.

3. A firm's export experience in a foreign market should affect its decision to start investing there, particularly in the face of more uncertain demand and supply conditions.

3.6 Export-supporting FDI

In line with standard models of the proximity concentration tradeoff (e.g., Markusen, 1984; Brainard, 1997; Helpman *et al.*, 2004), our paper focuses on firms' choice between serving a foreign market via exports and establishing foreign production facilities.

Recent studies (e.g., Krautheim, 2007; Arkolakis, 2010; Aeberhardt *et al.*, 2009) have emphasized the importance of "export-supporting FDI", i.e., investments in foreign subsidiaries established to set up distribution centers and sales offices to penetrate export markets. In the remaining of this section, we show that the logic of our theoretical model can be applied to a setting in which exporting firms decide between distributing their exports through a local agent and establishing their own distribution network.

In this case, firms face a tradeoff between the higher variable costs of using local distributors and the higher fixed costs of setting up foreign distribution centers and sales offices. We can derive conditions under which firms will follow a process of gradual

[16]Under this alternative formulation, the profitability threshold above a firm exporting at $t = 1$ will find it optimal to set up a foreign subsidiary at $t = 2$ is equal to $\mu^{EI\prime} = \frac{2f^I}{\tau} + \frac{\tau}{2} < \mu^{EI}$. The probability of a switch from export to FDI will thus be $1 - G(\mu^{EI\prime}) > 1 - G(\mu^{EI})$.

involvement in foreign markets, using local distributors before establishing their own distribution network.

Consider a representative firm producing good k which must decide whether to export to foreign market i, and whether to do so through local agents or by setting up its own distribution network. As in the model described above, we normalize unit production costs to zero and denote unit trade costs with τ_{ik}. If the firm relies on a local agents, we assume that its unit distribution costs are equal to c_{ik}. If instead the firm invests in its own distribution network in the host country, the unit distribution costs are equal to $c_i k - \phi$. Independently of the mode of distribution, the firm incurs a sunk export cost F^E_{ik}, (e.g., capturing the costs of dealing with customs procedures). To establish its distribution network, it incurs an additional one-time fixed cost F^I_{ik}. Dropping country and sector subscripts to simplify notation, first-period profits of the exporting firm are given by $\Pi^E = (\mu - q^E - \tau)q^E - F^E$, if it uses a local distributor, and $\Pi^I = (\mu + \phi - q^I - \tau)q^I - F^E - F^I$, if it invests in its own distribution network. Solving for optimal export quantities and substituting them back into the profit functions, first-period profits can be rewritten as

$$\Pi^E = \frac{1}{4}(\mu - \tau)^2 - F^E \tag{24}$$

and

$$\Pi^I = \frac{1}{4}(\mu + \phi - \tau)^2 - F^E - F^I. \tag{25}$$

Recall from equation 2 that $\mu \equiv a - c$ captures the profitability of serving the foreign market, which depends on both demand and supply conditions. Consider a scenario in which $E\mu = (F^E)^{1/2} + \frac{\tau}{2}$. This is the limit case in which, absent uncertainty, the firm would not enter the foreign market. Uncertainty makes it optimal for the firm to "test" the foreign market, by exporting small quantities and using local distributors. After the initial trial phase, the firm will decide to exit the foreign market, continue to export via local distributors, or establish its own distribution network. The probability that the firm will start investing is equal to $1 - G(\tilde{\mu})$, where

$$\tilde{\mu} = \frac{2F^I}{\phi} - \frac{\phi}{2} + \tau. \tag{26}$$

As in the case of horizontal FDI, uncertainty about foreign market conditions can thus lead firms to delay export-supporting FDI. The three empirical predictions derived above will thus apply to this alternative internationalization decision.

Notice, however, that investments aimed at facilitating export activities differ from horizontal FDI in two important ways. First, exports should increase (rather than decrease) following FDI. Second, higher trade barriers should decrease (rather than increase) the likelihood that an exporting firm starts engaging in FDI. To verify this, notice that the threshold identified by equation (26) is increasing in the extent of trade costs. The intuition for this result is simple: trade costs reduce the volume of exports over which the firm can amortize the fixed costs F^I.

4 Datasets and variables

The goal of our empirical analysis is to assess the validity of the predictions of our model on firms' decisions on how to serve foreign markets over time. For this purpose, we use different datasets from the National Bank of Belgium (NBB), which provide detailed information on firms' operations in individual foreign markets, covering the whole population of companies registered in Belgium since the early 1990's. This information can be linked to firm-level accounts through the value added tax (VAT) number, a unique code identifying each firm.

In general, firms can serve foreign buyers through three main channels: they can export their products to foreign customers, serve them through foreign subsidiaries, or license foreign firms to produce their products. In line with our theoretical model, and given the very limited role played by licensing,[17] we focus on the first two channels.

In this section, we first describe all the variables used in our empirical analysis (see Table A-1 in the Appendix). We then provide some descriptive statistics for the main variables of interests.

4.1 Export data

Annual data on exports since 1993 come from the NBB Foreign Trade dataset, which allows us to identify the countries to which a firm is exporting in a given year. Trade data on individual transactions concerning exports or imports are collected separately at company level for intra-EU (Intrastat) and extra-EU (Extrastat) trade. For each transaction, this data gives the product code, the type of transaction, and the destination or origin of the goods, the value, the net mass and units.

In our analysis, we use information from Extrastat, since we examine foreign activities of Belgian firms outside the EU Single Market, in which Belgian firms are likely to face

[17] Only a tiny minority of Belgian firms (i.e., less than 0.4%) engage in foreign markets via licensing.

more uncertain market conditions.[18] Extrastat contains exact information on trade flows with countries outside the European Union. The data is collected by customs agents and centralized at the NBB. It covers a larger share of the total trade transactions than Intrastat data, since all flows are recorded (unless their value is smaller than 1,000 euro or their weight is less than 1,000 Kg).[19]

4.2 FDI data

Data on FDI comes from the yearly Survey on Foreign Direct Investment of National Bank of Belgium. Conducted on a yearly basis since 1997,the survey provides information on firms involved in foreign direct investment relations. FDI is defined as international investments through which a resident entity in one economy acquires or has acquired a lasting interest in a resident entity of another economy than that of the investor. The Survey on Foreign Direct Investment includes all companies holding at least 10 percent of the social capital of foreign firms and those of which at least 10 percent of the shares are owned by foreign investors. All these firms are required to report their FDI stocks and flows in individual foreign countries as of the 31st December of the previous year.

Data in the Survey on Foreign Direct Investment is organized into investment "projects". In line with our theoretical model, we are interested in the determinants of a firm's decision to *start* investing in a foreign country, rather than on the timing of different investment projects. We thus focus on the first FDI entry (i.e., the first time a Belgian firm opens a subsidiary in given foreign market), aggregating all FDI projects that a firm has in a foreign country in a given year.[20]

As stressed in the introduction, Markusen and Maskus (2003) and Blonigen (2005) argue that most FDI is horizontal in nature. Indeed, UNCTAD (2011) reports that over the period 1990-2010 less than 20 percent of foreign affiliate sales worldwide is exported outside the host country, suggesting that most FDI is mostly driven by market-access considerations.

Unfortunately, the Survey on Foreign Direct Investment does not contain information

[18]The EU Single Market comprises the 27 EU Member States plus Iceland, Liechtenstein and Norway through the European Economic Area. Switzerland is also considered part of it because it has a series of bilateral treaties with the EU.

[19]By focusing on destinations outside the EU Single Market and relying on customs data, we also avoid problems of time inconsistency of firms' export status. These arise when using the Intrastat dataset, due to changes in the threshold used to define which firms have to report exports. See Muuls and Pisu (2007) for a detailed discussion of the NBB trade datasets.

[20]See Raff and Ryan (2008) for an analysis of the timing of FDI projects in a given country using Japanese manufacturing data.

on sales of foreign affiliates, which would help us to directly identify foreign investments aimed at serving customers in the host country. However, other kinds of data from the NBB can be used to indirectly distinguish different types of FDI. For example, we can use information on the evolution of a firm's exports to a foreign country before and after it starts investing in that country. In some instances, firm's exports dramatically fall after FDI entry, suggesting horizontal FDI. This is the case, for example, of a Belgian pharmaceutical company that started exporting to the United States in 1999 and opened its first foreign affiliate there in 2002: in the three years between export and FDI entry, the firm's exports grew by 189 percent, while in the three subsequent years they decreased by 88 percent. In other cases, a firm's export exhibit a strong increase following FDI entry, suggesting export-supporting FDI. This is the case, for example, of a Belgian company producing industrial process control equipment which started investing in the United States in 2000, after three years of export experience: in the three years before FDI entry, the firm's exports grew by 51 percent, while in the following three years they grew by 404 percent. As stressed in Section 3.6, the logic of our theoretical model applies not only to horizontal FDI – investments in foreign subsidiaries established to serve the host country – but also to export-supporting FDI – investments in foreign distribution centers and sales offices to penetrate export markets.

In some robustness checks, we use information on intra-firm trade from the Survey on Foreign Direct Investment (i.e., data on trade between Belgian firms and their foreign affiliates) to rule out some FDI entries as being potentially vertical in nature. In particular, we can exclude from our empirical analysis FDI entries that give rise to "substantial" imports from foreign affiliates (exceeding a given share of the affiliate's value added).

4.3 Firm-level controls

The Central Balance Sheet Office of the NBB collects the annual accounts of all companies registered in Belgium. They provide measures for firms' value added, turnover, intermediate consumption, employment, and capital stock. Using this data, we control for firm heterogeneity: the variable $Employment_{f,t}$ measures the number of full-time equivalent employees and is used as a proxy for firm size; and the variable $Productivity_{f,t}$ measures the firm's value added per employee.

We also exploit information concerning foreign ownership and multinational status from the Survey on Foreign Direct Investment described above. In this way, we define the dummy ($MNE_{f,t}$) when a Belgian firm is a multinational enterprise (i.e., it is the

recipient of foreign FDI) following the IMF's Balance of Payments Manual.[21]

Our theoretical model shows that, when faced by uncertain market conditions in foreign markets, a firm may find it optimal to "test" a foreign markets via exports, before possibly switching to FDI. In particular, our model suggests that a firm's decision to establish foreign affiliates in a foreign market may depend on its export experience in that market. To examine the role of export experience in explaining FDI entry decisions, we use data from the NBB Foreign Trade dataset to define the variable *Export entry*$_{f,i,t}$, which is coded as 1 when firm f starts exporting to country i in year t, not having exported to that country for at least the previous four consecutive years. Notice that this definition is more stringent than the one used in recent empirical studies of export dynamics (e.g., Eaton *et al.*, 2008; Ruhl and Willis, 2008). In these studies, any firm that exports to a given market in a particular year, after at least one year of no exporting, is classified as a "new exporter". We use a more stringent definition for two reasons. First, since we are interested in verifying whether uncertainty about foreign market conditions affects the dynamics of firms' internationalization choices, we do not want to classify as "new exporters" firms that may have simply interrupted exports for one year and may have already acquired a lot of experience in a foreign market. Second, since we have export data from 1993 and can observe FDI entries as of 1997, our definition of export entry avoids the problem of left censoring when defining the export experience of firms that start investing in a foreign market.

The variable *Experience*$_{f,i,t}$ measures the number of years a firm f has been exporting to country i since it started serving it. In our analysis, we control for other sources of learning and experience, which might also affect a firm's decision to start investing in a given country. To capture possible learning spillovers across markets, we construct the variables *Exports in region*$_{f,r,t-1}$ and *FDI in region*$_{f,r,t-1}$, which measure respectively the number of countries in continent r in which firm f is exporting to and in which it has foreign affiliates at $t-1$.[22]

Finally, when comparing the internationalization choices of individual firms in different markets, we can include firm fixed effects, which allow us to control for the role of unobserved time-invariant firm characteristics.

[21] According to this definition, a multinational enterprise is one in which a foreign investor owns, either directly or indirectly, 10 percent or more of its capital or voting power. All companies operating in Belgium which fall into this category are obliged to fill in the questionnaire by law. This applies to firms resident in Belgium in which a foreign investor holds a stake, i.e., foreign-owned firms, and to Belgian companies having a stake in enterprises operating abroad, i.e. Belgian multinationals.

[22] It may also be the case that a Belgian firm learns through spillover effects from other Belgian firms serving the same market with exports or FDI. These are sectoral variables which are discussed in the relevant subsection.

4.4 Country-level controls

We have collected standard macro variables that can affect firms' decision to serve a foreign market, such as $GDP_{i,t}$ and $GDP\ per\ capita_{i,t}$, which proxy for the size of the destination market and its level of development.

We also include in our analysis information on countries' regulatory environment from Kaufmann *et al.* (2009). The index $Regulation_{i,t}$ captures perceptions of the ability of the government of country i to formulate and implement sound policies and regulations aimed at promoting private sector development (with higher values indicating better regulatory environments), which should clearly affect firms' decision to engage in FDI in a country.[23] To proxy for uncertainty in a country's regulations, we compute the variable $Variance\ Regulation_i$ (over the period 1997-2008).

We also use dummy variables from CEPII to control for cultural similarities ($Common\ Language_i$ and $Colony_i$) and we use data from the International Centre for Settlement of Investment Disputes (ICSID) to construct a dummy variable on whether a foreign country has a bilateral investment treaty with Belgium ($BIT_{i,t}$).

Finally, when comparing the internationalization choices of different firms in individual foreign markets, we can include country fixed effects to control for the role of time-invariant country characteristics.

4.5 Sectoral controls

Our theoretical model suggests that the dynamics of firms' internationalization choices should depend, among other things, on uncertainty in foreign demand. We would expect firms that are more uncertain about preferences of foreign consumers or about the adequacy of their products to local tastes to follow a more gradual internationalization process. To verify this prediction, we construct the variable $Differentiated_k$, which measures the degree of product differentiation of the industry in which a given firm operates. To construct this measure, we rely on the well-known index devised by Rauch (1999), who classifies products according to three different types: homogeneous goods, which are traded in organized exchanges; goods that are are not traded in organized exchanges, but for which a published reference price can be found; and differentiated goods, which fall under neither of the two previous categories.

To apply Rauch (1999)'s measure to our analysis, we had to match the sector classification used in his analysis (SITC Rev.2 at 4 digits) with the NACE classification used

[23] We have also tried including the variable $Rule\ of\ law_{i,t}$ from Kaufmann *et al.* (2009), obtaining similar results.

in the Belgian data. To do so, we proceeded in two steps. First, we used the conversion tables by Affendy *et al.* (2010) to map SITC Rev.2 4-digit sectors into ISIC Rev.2 4-digit sectors. For each ISIC code, we computed the fraction of subsectors that are classified as being differentiated according to Rauch. Second, using correspondences from Eurostat, we mapped ISIC Rev.2 4-digit sectors into NACE Rev.1 3-digit sectors.[24] For each 3-digit NACE manufacturing industry, we then constructed the variable $Differentiated_k$, which measures the share of subsectors of industry k that are classified by Rauch (1999) as being differentiated.[25]

Our theoretical model focuses on the acquisition of market-specific knowledge by individual firms. In our empirical analysis, we also try to account for possible learning spillovers between Belgian firms by constructing the variables $Exports\ by\ other\ firms_{i,t-1,k}$ and $FDI\ by\ other\ firms_{i,t-1,k}$. These regressors measure, respectively, the number of Belgian firms in sector k (at the 2-digit NACE) exporting or having foreign affiliates in country i at $t-1$.

When comparing the internationalization choices of different firms, we can also include sector fixed effects, which allow us to control for the role of any time-invariant sectoral characteristics.[26]

4.6 Trade costs

Trade costs include both transport costs and trade barriers. To control for transport costs, we use the variable $Distance_i$, which measures the distance between the capital of Belgium and the capital of country i.

To control for trade barriers, we constructed time-varying measures of applied tariffs by sector and destination, starting from the disaggregate tariff line data available in the World Integrated Trade Solution (WITS). The procedure to construct average tariffs is rather cumbersome and involves different steps. The original tariff data are reported at the 6-digit level of the Harmonized System (HS6), while the activity of a firm, as identified in the Belgian annual accounts, is defined by a 5-digit code from the NACE classification. We thus aggregated HS data into NACE codes, taking into account that

[24] This level of aggregation minimizes the number of multiple matches, since NACE activities at the 3-digit level are comparable to ISIC activities at the 4-digit level.

[25] For example, NACE sector 156 (Manufacture of grain mill products, starches and starch products) matches into 2 ISIC codes, 1531 and 1532, which themselves are matched to various SITC codes. For ISIC sector 1531, 4 out of 9 SITC goods are classified by Rauch as being differentiated. For ISIC sector 1532, 3 out of 8 SITCS subsectors are classified as differentiated. This implies that, for NACE sector 156, 7 out of 17 subsectors are differentiated, so the variable $Differentiated_k$ takes the value of 0.4118.

[26] Sector fixed effects cannot be included when comparing the internationalization choices of individual firms in different markets, since most firms do not change sector over time.

the HS classification changed various times during our sample period. In order to minimize the subjectivity of such procedure, we relied on the fact that WITS also reports average tariffs aggregated at the 3 digits of the ISIC (revision 3) classification. We found a one-to-one mapping between 3-digit ISIC and 4-digit NACE classification for about 30 percent of the NACE codes. When an ISIC code could map into more than one NACE code, we recovered the HS6 tariff lines underlying the ISIC code and manually assigned them to NACE codes. This procedure was straightforward for about 33 percent of NACE codes. In the remaining cases, some discretion had to applied. For about 14 percent of the NACE codes, it was impossible to assign only one NACE code to each given HS6. In this case, we used a higher level of aggregation by imputing the average tariff of a given ISIC code to the NACE codes assigned to it.[27] Obviously, whenever working directly with HS6 tariff data, we tracked the changes in the HS classifications that occurred over time to ensure consistency. Using this procedures, we have been able to construct the variable $Tariff_{i,t,k}$, which measures the average tariff applied by country i over the previous three years vis-à-vis imports from Belgium in sector k (at the 4-digit NACE).

5 Descriptive statistics

In this section, we provide descriptive statics for the main variables of interests in our analysis. All the tables reporting these statistics can be found in the Appendix.

We restrict our attention to manufacturing firms (i.e., four-digit codes belonging to sectors between 15 and 37 of NACE revision 1) and impose a threshold in terms of employment (i.e., more than 5 employees). In terms of countries, we only consider destinations outside the EU Single Market, in which Belgian firms are likely to face more uncertain market conditions. We further restrict our attention to members of the WTO (as of 2010).

5.1 Export and FDI activities

As discussed above, our interest is on export and FDI activities of Belgian firms outside the European Single Market (SM). In Table A-2 we thus reports descriptive statistics for all destinations and then for those 'Outside SM'. Notice that Belgian firms are very open: over the entire sample, on average 52 percent of firms with more than 5 employees

[27] In these cases, we are aggregating at a level intermediate between 3 and 4-digit NACE, since an ISIC code is a subset of a 3-digit NACE code.

export. The number of Belgian firms is roughly constant during the sample, with the exception of 2008, when the number of firms decreases substantially as a result of the economic and financial crisis. The total number of exporting firms is decreasing over time, but this observation may be partly driven by the fact that the minimum threshold required for firms to report their intra-EU exports has significantly increased during the period. Instead the figures regarding firms exporting outside the Single Market are not biased, since the threshold required for firms to report their export activities outside the EU has remained constant during the sample period (i.e., all transactions whose value is higher than 1,000 euro or whose weight is bigger than 1,000 Kg). The number of firms exporting outside the single market has not changed significantly during our sample, again with the exception of 2008.

Table A-4 provides an overview of the top ten destinations and manufacturing sectors for export and FDI activities, distinguishing between all possible destinations in the world and those outside the Single Market. In terms of destinations, it is no surprise that countries in Europe capture all but one of the top ten destinations, the exception being the United States. A similar description holds true for the location of FDI activities with the difference that two countries in Eastern Europe are also among the top receivers of Belgian FDI. When restricting attention to the countries outside the Single Market, the United States is always the top destination for both exports and FDI while the rankings of the other countries are less correlated. For example, China is the second most popular destination for FDI but only the ninth for exports. Overall, the concentration of FDI activities across locations is also much higher than for export markets, as expected.

Table A-5 lists the top ten manufacturing sectors involved in export and FDI activities, both all over the world or only outside the Single Market. Some sectors (e.g., manufacturing of food products and beverages; manufacture of machinery and equipment) feature in top positions in all columns of the table while for some others there is quite a bit of heterogeneity when comparing export and FDI activities by their geographical dimension.

Table A-2 shows that the number of exporting firms is a subset of total firms and that firms engaging in outward FDI are an even smaller group (4.6 percent of the total number of Belgian firms).[28] When considering the location of foreign affiliates, it is clear that most of them are located within the Single Market. However, the presence outside the Single Market is clearly increasing over time and reaching a peak in 2006, when the

[28]FDI data have been corrected to eliminate "gap" problems (i.e., situations in which a firm reports no FDI in a destination country in a given year, while its FDI stock was positive in the previous and subsequent year). The correction implies inputing a 1 when the identifier of the FDI project carried out by the firm is the same for the year before and after the occurrence of a 0.

number of firms with outward FDI is almost double than the number at the beginning of the sample. Table A-3 reports the total number of export and FDI relationships (i.e., firm-destination pairs) that Belgian firms maintain every year. The ratio of the figures in Tables A-2 and A-3 show that firms export to 13 countries on average. Restricting our attention to the firms that export outside the Single Market, we see that on average they serve 9 countries outside of the block, a number that is relatively constant over time. With respect to FDI, firms engaging in outward FDI maintain a simultaneous presence on average in 2.3 countries outside Single Market, a number also stable over time.

Table A-6 provides some information on the size and productivity of Belgian firms engaging in exports and FDI. In particular, we report summary statistics for those firms in our sample that in the first year of our sample (1997) do not export to any country (i.e., Domestic firms), those that export to at least one country, and those that engage in outward FDI in at least one country.[29] It should be stressed that these statistics are based on the sample of firms that export at least once to at least one country outside of the Single Market during our sample period. Thus, those firms defined as 'Domestic' in 1997 would be exporting at some other point in time and, as such, are probably larger and more productive that truly domestic firms (i.e., firms that do not export to any country in any period). With this caveat in mind, these descriptive statistics are in line with the sorting patterns suggested by the literature on heterogeneous firms and trade (e.g., Helpman *et al.*, 2004; Head and Ries, 2003). This suggest that, *at a given point in time*, the least productive firms only sell in the domestic market, the most productive ones engage in FDI, while the remaining ones export. In our empirical analysis, we will control for size and productivity and show that firms may change their mode of serving a foreign market *over time*.

5.2 Export entry

As discussed above, in our main empirical analysis, we classify a firm as a "new exporter" if it exports to a given market in a particular year, after at least four years of no exporting to that market. This definition of export entry guarantees that our measure of export experience is not left censored since we have export data since 1993 and we know of new FDI activities since 1997. It also allows us to focus on the internationalization choices of firms that have no previous experience in serving a given foreign market, which still need to acquire important information about local demand and supply conditions.

[29]The same patterns hold for any other year in our sample period.

In line with the findings of recent studies on firms' export dynamics, we find that most new exporters sell small amounts and disappear from export markets in the following period. Table A-8 shows that, out of all Belgian firms that enter a new market in year t, almost 60 percent of them do not survive in the export market in the following year. The survival probability of new exporters increases steadily in the following years: the "death rate" four years after export entry is less than 20 percent. As shown by Figure A-1, export volumes also increase significantly in the years following export entry. These findings are in line with the results of recent studies on export dynamics (e.g., Eaton *et al.*, 2008; Aeberhardt *et al.*, 2009; Lawless, 2009) and suggest a process of "trials and errors", in which firms initially test foreign markets to find out whether they can make profits serving them.

5.3 Export experience and FDI entry

The main goal of our empirical analysis is to verify how a firm's export experience in a foreign market affects its decision to start investing there. Table A-7 presents some statistics showing the number of firms that set up new foreign affiliates in a given year, taking 1996 as the reference year to identify firms engaging in new FDI starting in 1997.[30] The first column of Table A-7 shows that there is quite a lot of variation from year to year, with more action in the early years of the sample. Out of the total 1,349 new FDI affiliates, 418 were opened outside the Single Market, with the United States the preferred destination, followed by Brazil, China (and Hong Kong), and Mexico. Table A-7 also provides some evidence related to our theoretical model. In particular, it shows that most of the new FDI by Belgian firms takes place in countries where these firms were exporting beforehand (i.e., in any of the previous 4 years). Based on these figures, 73.5 percent of new affiliates were opened in countries where the Belgian firms undertaking the FDI were previously exporting. Notice that this is a lower bound, since some firms that start investing in a foreign market may have been exporting to it in previous years.

[30]FDI data for 1996 is derived from balance sheet data since the Survey of FDI only started in 1997. We compared the two sources for a common year (i.e., 1997) and the large majority of FDI reported in the survey are also reported in the balance sheet. The converse is not necessarily the case because of different methodologies with the survey being considered a more reliable source.

6 Empirical methodology and results

6.1 Empirical methodology

The central question of the literature on the proximity-concentration tradeoff is why a firm would choose to serve a foreign market through affiliate production, rather than exporting. Existing empirical studies address this question from a *static* perspective, using cross-sectional data to examine the determinants of firms' exports and FDI decisions (e.g., Brainard, 1997; Helpman *et al.*, 2004; Ramondo *et al.*, 2010).

However, the descriptive statistics of exports and FDI decisions for Belgian firms show that the overwhelming majority of companies that start investing in a foreign market do so only after having previously served that market via exports. This suggests that firms' export and FDI decisions must be understood as part of a broader *dynamic* internationalization strategy, as suggested by our theoretical model. This dynamic process calls for the use of particular econometric techniques which take into account the nature of the phenomenon under investigation. To this end, we assess the predictions of our model using survival analysis (also called duration analysis) which emphasizes the time it takes for an event (i.e., FDI entry in our case) to materialize.[31] Survival analysis also takes into account the fact that the event of interest may not occur for some of the individuals (i.e., firms) under study by the end of the sample. Still, their inclusion in the analysis can provide valuable information. Survival analysis can be implemented in different ways but we will employ proportional hazard models, which are the most important and well-known ones. The objective of these models is to estimate the "hazard rate" $h_{f,i}(t)$, which is the probability that firm f starts investing in country i at time t, given that FDI entry did not occur earlier. The variables that can potentially explain the occurrence of an event are represented by a set of (time varying) regressors $X_{f,i,k,t}$ that correspond to the variables that we presented in the previous Section. Formally, a hazard model can be expressed as follows

$$h_{f,i}(t) = h_0(t) \exp(\beta X_{f,i,k,t}) \tag{27}$$

where $h_0(t)$ represents the baseline hazard rate, $X_{f,i,k,t}$ is the matrix of regressors and β is the vector of coefficients to be estimated. The formulation in (27) clarifies why this type of models are proportional: any change in the explanatory variables results in a new hazard rate $h_{f,i}(t)$ that is proportional to the baseline hazard rate independently of

[31] Typically, survival analysis is used by labor economists investigating issues such as the duration of unemployment.

the time variable. Equation (27) specifies a general proportional hazard model but its estimation requires a further assumption about the baseline hazard rate $h_0(t)$. For the most part of our analysis, we will not actually estimate it so that we remain agnostic on its functional form. This choice leads to the Cox model, which is widely used and is a semi-parametric model (parametric in the regressors but not for the baseline hazard rate). The flexibility of the Cox model comes at the cost of a loss of efficiency compared to a situation where an appropriate form for the baseline hazard rate is imposed. However, an incorrectly specified baseline rate would lead to inconsistent estimates. For this reason, we only use a full parametric model as a robustness check, and its estimates should not systematically differ from the ones obtained with a semi-parametric model if the baseline hazard rate is not mis-specified. For this robustness check, we will estimate a Weibull model, which specifies

$$h_0(t) = pt^{p-1} \exp(\beta_0) \tag{28}$$

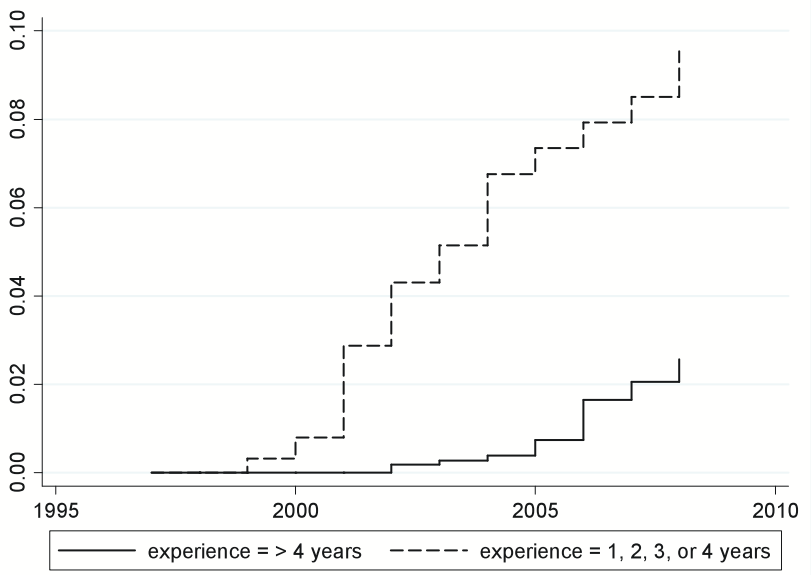
where $p > 0$ is an ancillary parameter to be estimated and β_0 is a constant. The baseline hazard rate is constant if p is equal to 1 while it is increasing (decreasing) for p above (below) 1. The sample for the analysis includes all the new export entries occurring during the period 1997-2008 in a country outside the Single Market. Starting from the year when such an entry occurs, each firm is tracked over time until that firm opens a subsidiary in that country or until the end of the sample if no FDI ever occurs. It is important to point out that in a survival analysis framework, each firm is included in the analysis until the time when the event under investigation occurs (i.e., FDI entry). After that point, no more information can be learned from that firm. Instead, a firm that never engages in FDI will be included until the end of the sample.

6.2 Export experience and FDI entry

The key prediction of our theoretical model is that export experience in a given country is a fundamental determinant of the decision to open a subsidiary in that same country since it allows the firm to learn about its profitability in that market. In order to provide a first look of the data, in Figure (3) we plot the Kaplan-Meier cumulative hazard function, which depicts the cumulative probability of FDI entry over time based on the count of occurring FDI entries in each period out of the total number of firms that may start FDI. The figure distinguishes the cumulative hazard functions by the extent of export experience and it clearly shows that FDI entries are much more likely among firms with an export experience between 1 and 4 years, compared with those

with longer export experiences.

Figure 3: Kaplan-Meier failure estimates



Although illustrative of the role of export experience, Figure (3) cannot be used to uncover the determinants of FDI entry. To this end, Tables 1 and 2 report the estimates of various specifications using the Cox model.

The main difference between these two tables is the strategy that we use to identify the role of export experience. In particular, in Table 1 we exploit the variation within firms across different destinations. In other words, we include firm fixed effects, which control for time-invariant characteristics, thus retaining only those firms that enter with new FDI in at least one market. Instead, in Table 2 we exploit the variation among firms exporting to the countries that experience at least one FDI entry by Belgian firms by including country fixed effects instead of firm firms effect. In this case, only countries where at least one firm opens a subsidiary are retained but firms that never engage in new FDI are included, leading to a much bigger sample.

In both tables, we measure export experience in two different ways. In a first set of specifications, we include dummy variables for firms with different years of export experience since they became new exporters to a given destination. In a second set of regressions, we use the logarithm of (one plus) the years of export experience as an alternative way to capture nonlinear effects of export experience.

Column (1) of Table 1 reports the estimates of a parsimonious specification where

only the dummy variables capturing export experience are included together with the firm fixed effects. The coefficients clearly suggest a positive and nonlinear effect: the importance of export experience decreases over time and it is only significant at 10 percent once a firm reaches 5 years of export experience (compared to the omitted category of 7 or more years of experience). This result is confirmed when using the log version of export experience in column (4), whose estimated coefficient is also highly significant and positive. In column (2) we add some country specific regressors. The results on the nonlinear effects of export experience are robust, with the estimated coefficient for $Experience56_{f,i,t}$ now insignificant, suggesting that the four initial years after becoming a new exporter are crucial in order to decide whether to engage in FDI in the same location. As for the added country controls, $GDP_{i,t}$, $GDP\ per\ capita_{i,t}$, and $BIT_{i,t}$ exert a positive and significant effect, as expected, on the likelihood of FDI entry while $Distance_i$, $Common\ Language_i$, and $Colony_i$ are not significant.[32] In column (3) the applied tariff rate is added at the cost of losing almost 2000 observations and 11 FDI entries. Still, the qualitative results are identical with respect to the previous column, except for Distance_i that is now significant at 10 percent. The level of tariffs presents a positive but insignificant effect. However, the insignificance of this regressor in most of the specifications may be explained by various factors. First, this variable may be quite noisy because of its construction, which required bridging various classifications. Second, its role depends on the type of FDI taking place: higher tariffs should lead to more horizontal FDI but they would discourage export-supporting FDI.

The specifications in the last three columns of Table 1 include the log version of export experience. The results are qualitative similar to the respective columns with the experience dummies and confirm the nonlinear and decreasing role of export experience on FDI entry.

The regressions in Table 2 are based on a much bigger sample and they exploit the variation within a country between firms that open subsidiaries and those that do not. This table presents two extra columns because sector fixed effects (at 2-digit NACE) can be included along with the country fixed effects (although some observations are lost because not all sectors experience FDI entries). The relevance of export experience is confirmed: the dummy variables in the first 4 columns illustrate, again, the nonliner effect of experience emphasizing the role of the first 4 years, just as in the previous table. As for the firm level controls, larger firms and MNEs are more likely to engage in new FDI, although the effect of employment is not significant when the sector fixed effects

[32]We did try including time-varying firm variables (i.e., employment, productivity, and MNE) but they were never significant, most likely because of the little time variation).

are included. The level of tariffs presents a positive and significant effect only when the sector fixed effects are included. However, the insignificance of this regressor in the other specifications (and in the ones that follow) may be explained by various factors. First, this variable may be quite noisy because of its construction, which required bridging various classifications. Second, its role depends on the type of FDI taking place: higher tariffs should lead to more horizontal FDI but they would discourage export-supporting FDI.

The last four regressors try to capture different channels through which a firm may learn about demand and supply conditions in a destination market. The first two are "internal" to the firm and count the number of other countries in the same region that the firm was serving with exports and FDI. Both variables are significant and positive but they do not diminish the role of export experience in the specific market. The other two regressors are similar but count the number of other Belgian firms from the same 2-digit NACE sector that served the same market via FDI or exports. Interestingly, it seems that firms do not learn from each other since these regressors are never significant or they present a negative coefficient (possibly due to a competition effect), whose significance disappear when adding sector fixed effects.

The last 4 columns of Table 2 use the log of export experience and the results are qualitatively similar to the previous columns, except that employment now presents a consistently significant coefficient while the count of export destinations by the firm in the same region is only significant in one out of three specifications.

Overall, the various specifications of the Cox proportional model presented in Tables 1 and 2 confirm our theoretical prediction that export experience plays a crucial role in determining FDI entry. In the next Section, we proceed one step further to examine whether the role of experience is affected by the extent of country (supply) or sector-level (demand) uncertainty.

6.3 Learning and Uncertainty

Consistent with our model, it should also be that experience becomes all the more relevant in particularly uncertain destinations. To empirically verify whether this is the case, in Table 3 we report the estimates of various specifications where we interact the log of export experience with variables meant to capture supply and demand uncertainty in foreign markets. As discussed in section 4, we use $Variance\ Regulation_i$, which only varies at country level, as a measure of supply uncertainty. Instead $Differentiated_k$, which only varies at 3-digit NACE level, should capture uncertainty on the demand side

since it is based on the degree of product differentiation within a sector.

In the first 4 columns of Table 3, the log of experience is interacted with the variance of regulation and the variance and the level of regulation are also introduced as control variables. The estimates in the first 2 columns exploit the within-firm variation while the identification in columns (3) and (4) is based on comparing firms within a sector. In each case, the log of experience is positive and significant and its interaction with the variance of regulation is also positive and significant, indicating that export experience is more important for countries with higher variance of regulation. As expected, the variance of regulation presents a negative and significant sign while countries with higher standards of regulation are more likely to attract new FDI. The estimated coefficients for the other controls introduced in column (2) and (4) present the same qualitative effects as found in previous section.[33] [34]

In the last two columns of Table 3, we see that demand uncertainty also plays a role. In particular, the interaction of the log of experience with the measure of product differentiation based on Rauch (1999) is positive and significant. This suggests that export experience is more important in determining FDI entry decisions for firms selling more differentiated products.

In conclusions, the results show that export experience is more important in countries and sectors characterized by more uncertainty, which is consistent with our theoretical model based on the idea that firms need to learn about their profitability in destination markets.

6.4 Robustness checks

In this section, we discuss the results of a series of additional regressions aimed to verify the robustness of our main findings. Our theoretical model applies to horizontal and export-supporting FDI and, as mentioned in Section 4.2, a casual look at the data suggests that Belgian firms do engage in both types of FDI. Unfortunately, we cannot directly exclude the occurrence of vertical FDI, since our data do not directly report the reasons for which a firm opens subsidiaries in a foreign country. However, exploiting intra-firm data we can try to eliminate FDI entries that "look" vertical in nature. To this end, we compute the share of exports out of value added that the subsidiary ships

[33] We exclude $GDP\ per\ capita_{i,t}$ from these specifications because it is highly correlated with $Regulation_{i,t}$.

[34] In unreported results, we also estimated the same type of specifications using $Rule\ of\ law_{i,t}$ and its variance. Although less "supply" oriented than regulation, this index measures the enforceability of rules in a country, which should affect the fixed costs associated with serving a foreign market. The results when using this index are qualitatively similar.

back to the Belgian firm in the years following FDI entry. Then, we re-estimate our specifications excluding those FDI entries for which such share is above one third. The results of such exercise for representative specifications from each of the previous tables are reported in Table 4.

Focusing on the first row of Table 4, we immediately see that the result on the role of export experience is unchanged when some FDI entries are removed because of their suspected vertical nature. The first two columns report specifications from Tables 1 (with firm fixed effects) and 2 (with country fixed effects) and there is no significant change in the influence of the control variables on the likelihood of FDI entry. In columns (3) and (4), the role of uncertainty due to the variance of regulations is assessed, exploiting within-firm variation or within-sector variation. Again, the qualitative results are unchanged when these estimates are compared with their analogous in Table 3. Finally, the estimates in column (5) verify the role of product differentiation and earlier results on the relevance of this form of (demand) uncertainty are confirmed.

On a methodological front, we re-estimated all the specifications using the Weibull model, thus imposing a specific functional form for the baseline hazard rate. The results, not reported to save on space, do not show any qualitative change (in sign and significance) with respect to those obtained when estimating Cox proportional models. As expected, the ancillary parameter of the Weibull model is estimated to be above 1 and highly significant, implying an increasing baseline hazard rate.

Our final robustness check refers to the definition of FDI entry. In our main analysis, we focus on FDI entry decisions of "new exporters" (i.e., firms for which we can observe the year of export entry). This allows us to precisely measure the export experience of firms that start investing in a foreign market, but forces us to exclude from our analysis all FDI entries of "old exporters" (i.e., firms for which we cannot observe the year of export entry). To recover these entries, we can treat all firms identically and simply count the number of years in which a firm has positive exports to a market over the previous four. [35] Using this less precise measure of export experience allows us to keep all the 408 FDI entries that have occurred outside the EU Single Market over our sample period. Cox regressions on this larger sample of FDI entries confirm that the probability that a firm starts investing in a foreign country depends significantly on the number of years the firm has been exporting to that country, and that export experience matters more when firms face more uncertain market conditions.

On a methodological front, we re-estimated all the specifications using the Weibull

[35]Notice that this measure of export experience does not suffer from left censoring, since we can observe exports during the four previous years for all FDI entries over the period 1997-2008.

model, thus imposing a specific functional form for the baseline hazard rate. The results, not reported to save on space, do not show any significant change with respect to those obtained with the Cox proportional model. As expected, the ancillary parameter of the Weibull model is estimated to be above 1 and highly significant, implying an increasing baseline hazard rate.

7 Conclusions

This paper analyzes how the need to uncertainty affects a firm's choice of serving a foreign market by exporting or opening a foreign affiliate. We develop a simple dynamic model of internationalization choices based on two key assumptions: first, a firm can only gain knowledge about a foreign market by operating there; second, export involve lower fixed costs than FDI, but higher variable costs of transportation and trade barriers. We show that the need to acquire information about foreign market conditions can lead to a gradual internationalization process: the firm will first "test" the foreign market via exports to find out local supply and demand conditions; if it discovers that its profitability in that market is high enough, it will then establish foreign production facilities.

Our empirical analysis, based on detailed information on export and FDI activities in individual destination markets for all companies registered in Belgium, provides strong support for the predictions of our model. We find that the overwhelming majority of firms start serving a foreign market through exports. After an initial "trial" period", most firms exit the foreign market, some continue to export, and a few open foreign affiliates. Moreover, a firm's export experience in a foreign country has a crucial impact on its decision to start investing there, and the effect is stronger in the face of more uncertain supply and demand conditions.

Our results show that exports and horizontal FDI may be substitutes from a static perspective – since they represent alternative ways of serving a foreign market – but complements over time – since the knowledge acquired through export experience can lead firms to invest abroad. Standard internationalization models that abstract from market uncertainty and learning predict that lower trade costs should lead firms to substitute affiliate production for exports. Trade liberalization should thus lead to a fall in FDI. In contrast , our analysis suggests that trade liberalization may actually foster FDI, by allowing firms to experiment in foreign markets via exports.

References

Aeberhardt, R., Buono, I., and H. Fadinger (2009). "Learning and the Dynamics of Exporting: Theory and Evidence from French Firms," mimeo, University of Vienna.

Affendy, A.M., L. S. Yee, and S. Madono (2010). "Commodity-industry Classification Proxy: A Correspondence Table between SITC Revision 2 and ISIC Revision 3," *Journal of International Economic Studies* 24, 185-202.

Albornoz, F., H. Calvo-Pardo, G. Corcos, and E. Ornelas (2010). "Sequential Exporting," CEP Discussion Paper No 974.

Arkolakis, C. (2010). "Market Penetration Costs and the New Consumers Margin in International Trade," *Journal of Political Economy* 118, 1151-1199.

Blonigen, B. A. (1997). "Firm-Specific Assets and the Link Between Exchange Rates and Foreign Direct Investment," *American Economic Review* 87, 447-465.

Blonigen, B. A. (2005). "A Review of the Empirical Literature on FDI Determinants," *Atlantic Economic Journal* 33, 383-403.

Brainard, L. S. (1997). "An Empirical Assessment of the Proximity- Concentration Trade-off Between Multinational Sales and Trade," *American Economic Review* 87, 520-544.

Brouthers, K. D., L. E. Brouthers, and S. Werner (2008). "Real Options, International Entry Mode Choice and Performance," *Journal of Management Studies* 45, 936-960.

Chi, T. (2000). "Option to Acquire or Divest a Joint Venture," *Strategic Management Journal* 21, 665-687.

Chi, T., and D. J. McGuire (1996). "Collaborative Ventures and Value of Learning: Integrating the Transaction Cost and Strategic Option Perspectives on the Choice of Market Entry Modes," *Journal of International Business Studies* 27, 285-307.

Dixit, A. K., and R. S. Pindyck (1994). *Investment and Uncertainty.* Princeton, NJ: Princeton University Press.

Eaton, J., M. Eslava, M. Kugler, and J. Tybout (2008). "The Margins of Entry into Export Markets: Evidence from Colombia," in Helpman, H., Marin, D., and Verdier, T. (eds.), *The Organization of Firms in a Global Economy.* Cambridge, MA: Harvard University Press.

Eaton, J., M. Eslava, C. J. Krizan, M. Kugler, and J. Tybout (2010). "A Search and Learning Model of Export Dynamics," mimeo, Pennsylvania State University.

Ekholm, K., R. Forslid, and J. R. Markusen (2007). "Export-Platform Foreign Direct Investment," *Journal of the European Economic Association* 5, 776-795.

Freund, C. L., and M. D. Pierola (2010). "Export Entrepreneurs: Evidence from Peru," World Bank Policy Research Working Paper 5407.

Guiso, L., and G. Parigi (1999). "Investment and Demand Uncertainty," *Quarterly Journal of Economics* 114, 185-227.

Hanson, G., R. J. Mataloni, and M. J. Slaughter (2005). "Vertical Production Networks in Multinational Firms," *Review of Economics and Statistics* 87, 664-678.

Head, K., and J. Ries (2003). "Heterogeneity and the FDI versus Export Decision of Japanese Manufacturer," *Journal of the Japanese and International Economies* 17, 448-467.

Helpman, E., Melitz, M. J., and S. R. Yeaple (2004). "Export versus FDI with Heterogeneous Firms," *American Economic Review* 94, 300-316.

Horstmann, I., and J. R. Markusen (1992). "Endogenous Market Structures in International Trade," *Journal of International Economics* 32, 109-29.

Horstmann, I., and J. R. Markusen (1996). "Exploring New Markets: Direct Investment, Contractual Relations and the Multinational Enterprise," *International Economic Review* 37, 1-19.

Johanson, J., and Vahlne, J.-E. (1977). "The Internationalization Process of the Firm: A Model of Knowledge Development and Increasing Foreign Market Commitments," *Journal of International Business Studies* 8, 23-32.

Jovanovic, B. (1982). "Selection and the Evolution of Industry," *Econometrica* 50, 649-670.

Kaufmann, D., A. Kraay, and M. Mastruzzi (2009). "Governance Matters VIII: Aggregate and Individual Governance Indicators, 1996-2008," World Bank Policy Research Working Paper 4978.

Kumar, M. V. S. (2005). "The Value from Acquiring and Divesting a Joint Venture: a Real Options Approach," *Strategic Management Journal* 26, 321-331.

Krautheim, S. (2007). "Export-Supporting FDI," EUI Working Papers ECO 2007/24.

Lawless, M. (2009). "Firm Export Dynamics and the Geography of Trade," *Journal of International Economics* 77, 245-254.

Markusen, J.R., and K. E. Maskus (2003). "General-Equilibrium Approaches to the Multinational Firm: a Review of Theory and Evidence," in J. Harrigan and K. Choi (eds.), *Handbook of International Trade*. London, Basil Blackwell.

Markusen, J. R. (1984). "Multinationals, Multi-plant Economies, and the Gains from Trade," *Journal of International Economics* 16, 205226.

Markusen, J. R., and A. J. Venables (2000). "The Theory of Endowment, Intra-industry and Multinational Trade," *Journal of International Economics* 52, 209-34.

McDonald, R., and D. Siegel (1986). "The Value of Waiting to Invest," *Quarterly Journal of Economics* 101, 707-727.

Melitz, M. J. (2003). "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica* 71, 1695-1725.

Morales, E., G. Sheu, and A. Zahler (2011). "Gravity and Extended Gravity: Estimating a Structural Model of Export Entry." Mimeo, Harvard University.

Muuls, M., and M. Pisu (2007). "Imports and Exports at the Level of the Firm: Evidence from Belgium," CEP Discussion Paper No 801.

Raff, H., and M. Ryan (2008). "Firm-Specific Characteristics and the Timing of Foreign Direct Investment Projects," *Review of World Economics* 144, 1-31.

Ramondo, N., V. Rappoport, and K. J. Ruhl (2010). "The Proximity-Concentration Tradeoff under Uncertainty," mimeo, Arizona State University.

Rauch, J. E. (1999). "Networks Versus Markets in International Trade," *Journal of International Economics* 48, 7-35.

Rauch, J. E., and J. Watson (2003). "Starting Small in an Unfamiliar Environment," *International Journal of Industrial Organization* 21, 1021-1042.

Rob, R., and N. Vettas (2003). "Foreign Direct Investment and Exports with Growing Demand," *Review of Economic Studies,* 70, 629-648.

Ruhl, K., and J. Willis (2008). "New Exporter Dynamics," mimeo, New York University.

Unctad (2011). *World Investment Report 2011.*

Table 1: Export experience and FDI entry, comparison within firms

	(1)	(2)	(3)	(4)	(5)	(6)
Experience12$_{f,i,t}$	1.923***	1.927***	1.870***			
	(0.407)	(0.360)	(0.362)			
Experience34$_{f,i,t}$	1.672***	1.551***	1.325***			
	(0.471)	(0.421)	(0.421)			
Experience56$_{f,i,t}$	1.215*	0.913	0.536			
	(0.626)	(0.577)	(0.610)			
Log Experience$_{f,i,t}$				1.726***	1.532***	1.430***
				(0.228)	(0.223)	(0.250)
GDP$_{i,t}$		0.220***	0.229***		0.180***	0.191***
		(0.054)	(0.060)		(0.051)	(0.053)
GDP per capita$_{i,t}$		0.040***	0.038**		0.036***	0.033**
		(0.013)	(0.015)		(0.012)	(0.014)
BIT$_{i,t}$		1.460***	1.305***		1.317***	1.193***
		(0.294)	(0.336)		(0.282)	(0.322)
Distance$_i$		0.056	0.077*		0.051	0.070*
		(0.041)	(0.040)		(0.038)	(0.038)
Common Language$_i$		0.219	0.509		0.235	0.537
		(0.467)	(0.465)		(0.440)	(0.435)
Colony$_i$		-0.680	-0.522		-0.409	-0.273
		(1.089)	(1.042)		(1.180)	(1.142)
Tariff$_{i,t,k}$			0.407			0.112
			(1.180)			(1.183)
Firm fixed effects	yes	yes	yes	yes	yes	yes
Observations	9,210	8,762	6,922	9,210	8,762	6,922
Export entries	1,570	1,506	1,395	1,570	1,506	1,395
FDI entries	74	74	63	74	74	63
Log likelihood	-497.2	-463.4	-379.6	-488.2	-462.8	-381.6

Notes: The table reports the estimated coefficients of Cox models, with robust standard errors in parenthesis. The dependent variable is equal to 1 if firm f in sector k starts investing in foreign country i at time t. The sample period is 1997-2008. * denotes significance at the 10% level, ** 5% level, and *** 1% level.

Table 2: Export experience and FDI entry, comparison within countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Experience12$_{f,i,t}$	1.634***	1.688***	1.689***	1.688***				
	(0.331)	(0.355)	(0.353)	(0.351)				
Experience34$_{f,i,t}$	1.339***	1.220***	1.224***	1.216***				
	(0.356)	(0.397)	(0.395)	(0.396)				
Experience56$_{f,i,t}$	0.911*	0.573	0.575	0.540				
	(0.492)	(0.553)	(0.553)	(0.556)				
Log Experience$_{f,i,t}$					0.949***	0.865***	0.866***	0.857***
					(0.144)	(0.175)	(0.176)	(0.177)
Employment$_{f,t}$		0.216**	0.194*	0.277		0.297***	0.267***	0.353**
		(0.103)	(0.101)	(0.169)		(0.095)	(0.096)	(0.174)
Productivity$_{f,t}$		0.001	0.001	0.001		0.001	0.001	0.001
		(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
MNE$_{f,t}$		1.120***	1.082***	1.043***		0.988***	0.953***	0.895***
		(0.333)	(0.330)	(0.322)		(0.317)	(0.314)	(0.310)
Tariff$_{i,t,k}$		-0.110	-0.151	1.613*		0.027	-0.029	1.708**
		(0.598)	(0.479)	(0.905)		(0.517)	(0.424)	(0.774)
FDI in region$_{f,r,t-1}$		0.250***	0.241***	0.233***		0.251***	0.241***	0.222**
		(0.087)	(0.084)	(0.078)		(0.093)	(0.089)	(0.087)
Exports in region$_{f,r,t-1}$		0.042**	0.048***	0.045**		0.029	0.034*	0.031
		(0.017)	(0.018)	(0.020)		(0.018)	(0.019)	(0.020)
FDI by other firms$_{i,t-1,k}$			0.082	-0.008			0.069	-0.020
			(0.085)	(0.107)			(0.084)	(0.106)
Exports by other firms$_{i,t-1,k}$			-0.008**	0.003			-0.008**	0.004
			(0.004)	(0.007)			(0.004)	(0.007)
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Sector fixed effects	no	no	no	yes	no	no	no	yes
Observations	116,793	82,662	82,662	78,446	116,793	82,662	82,662	78,446
Export entries	23,067	18,406	18,406	17,403	23,067	18,406	18,406	17,403
FDI entries	74	61	61	61	74	61	61	61
Log likelihood	-703.8	-534.0	-532.1	-515.2	-703.4	-537.5	-535.6	-519.2

Notes: As in Table 1.

Table 3: Export experience and FDI entry, the role of uncertainty

	(1)	(2)	(3)	(4)	(5)	(6)
Log Experience$_{f,i,t}$	1.411***	1.154***	0.772***	0.724***	0.653***	0.631***
	(0.227)	(0.270)	(0.159)	(0.181)	(0.200)	(0.217)
Log Experience$_{f,i,t}$*Var. Regulation$_i$	9.337**	11.666***	9.959**	10.583***		
	(4.180)	(4.501)	(4.347)	(3.831)		
Var. Regulation$_i$	-18.807*	-23.122**	-18.353*	-20.919**		
	(9.698)	(10.315)	(9.445)	(9.110)		
Regulation$_{i,t}$	0.679***	0.556**	0.533***	0.508**		
	(0.156)	(0.225)	(0.163)	(0.238)		
Log Experience$_{f,i,t}$*Differentiated$_k$					0.512*	0.443*
					(0.266)	(0.263)
Differentiated$_k$					-0.910*	-0.674
					(0.488)	(0.497)
GDP$_{i,t}$		0.204***		0.180***		
		(0.046)		(0.048)		
BIT$_{i,t}$		0.992***		1.031***		
		(0.313)		(0.312)		
Distance$_i$		0.000		0.000		
		(0.000)		(0.000)		
Common Language$_i$		0.337		0.225		
		(0.415)		(0.492)		
Colony$_i$		0.788		1.061		
		(1.131)		(1.025)		
Tariff$_{i,t,k}$		0.383		0.653		
		(0.992)		(0.840)		
Employment$_{f,t}$				0.248		0.261***
				(0.183)		(0.096)
Productivity$_{f,t}$				0.001		0.001
				(0.001)		(0.001)
MNE$_{f,t}$				1.013***		0.938***
				(0.301)		(0.301)
FDI in region$_{f,r,t-1}$				0.255***		0.276***
				(0.062)		(0.076)
Exports in region$_{f,r,t-1}$				0.013		0.026
				(0.017)		(0.017)
Firm fixed effects	yes	yes	no	no	no	no
Sector fixed effects	no	no	yes	yes	no	no
Country fixed effects	no	no	no	no	yes	yes
Observations	9,202	6,922	238,094	154,227	114,823	99,535
Export entries	1,569	1,395	46,940	36,120	22,629	20,160
FDI entries	74	63	74	61	74	72
Log likelihood	-475.2	-377.9	-733.8	-552.2	-700.9	-649.5

Notes: As in Table 1.

Table 4: FDI entry and export experience, excluding vertical FDI

	(1)	(2)	(3)	(4)	(5)
Log Experience$_{f,i,t}$	1.383***	0.822***	1.122***	0.699***	0.566***
	(0.264)	(0.189)	(0.286)	(0.196)	(0.214)
Log Experience$_{f,i,t}$*Var. Regulation$_i$			10.488**	9.531***	
			(4.317)	(3.501)	
Var. Regulation$_i$			-20.950**	-18.401**	
			(10.003)	(8.251)	
Regulation$_{i,t}$			0.532**	0.527**	
			(0.242)	(0.261)	
Log Experience$_{f,i,t}$*Differentiated$_k$					0.503*
					(0.262)
Differentiated$_k$					-0.962*
					(0.491)
GDP$_{i,t}$	0.193***		0.197***	0.178***	
	(0.059)		(0.051)	(0.053)	
GDP per capita$_{i,t}$	0.027*				
	(0.014)				
Bilateral Investment Treaty$_{i,t}$	1.161***		0.977***	1.019***	
	(0.343)		(0.337)	(0.341)	
Distance$_i$	0.000**		0.000	0.000	
	(0.000)		(0.000)	(0.000)	
Common Language$_i$	0.318		0.094	-0.080	
	(0.521)		(0.499)	(0.623)	
Colony$_i$	0.025		1.111	1.534	
	(1.172)		(1.158)	(1.081)	
Tariff$_{i,t,k}$	-1.238	-0.455	-0.636	-0.109	
	(1.364)	(1.488)	(1.122)	(1.331)	
Employment$_{f,t}$		0.316***		0.276	0.305***
		(0.099)		(0.184)	(0.100)
Productivity$_{f,t}$		0.001		0.000	0.000
		(0.001)		(0.001)	(0.001)
MNE$_{f,t}$		0.979***		1.027***	1.067***
		(0.339)		(0.316)	(0.319)
FDI in region$_{f,r,t-1}$		0.336***		0.270***	0.398***
		(0.081)		(0.061)	(0.074)
Exports in region$_{f,r,t-1}$		0.035*		0.009	0.028
		(0.020)		(0.019)	(0.018)
Firm fixed effects	yes	no	yes	no	no
Sector fixed effects	no	no	no	yes	no
Country fixed effects	no	yes	no	no	yes
Observations	6,846	82,587	6,846	154,152	99,435
Export entries	1,384	18,395	1,384	36,109	20,149
FDI entries	56	54	56	54	61
Log likelihood	-333.1	-465.4	-329.6	-484.2	-536.8

Notes: As in Table 1.

Table A-1: Definition of variables and sources

Export entry$_{f,i,t}$	Dummy equal to 1 in the first year in which firm f has positive exports to country i (after at least 4 years of no exports)	NBB Foreign Trade Data
FDI entry$_{f,i,t}$	Dummy equal to 1 in the first year in which firm f has positive FDI stock in country i	NBB Survey on Foreign Direct Investment
Experience$_{f,i,t}$	Number of years since export entry of firm f in country i	NBB Foreign Trade Data
Experience12$_{f,i,t}$	Dummy equal to 1 if firm f has 1-2 years of export experience	NBB Foreign Trade Data
Experience34$_{f,i,t}$	Dummy equal to 1 if firm f has 3-4 years of export experience	NBB Foreign Trade Data
Experience56$_{f,i,t}$	Dummy equal to 1 if firm f has 5-6 years of export experience	NBB Foreign Trade Data
Log Experience$_{f,i,t}$	Log of (1+ Experience$_{f,i,t}$)	NBB Foreign Trade Data
Employment$_{f,t}$	Employment of firm f in year t (hundreds)	NBB Central Balance Sheet Data
Productivity$_{f,t}$	Value added of firm f divided by its employment (hundreds)	NBB Central Balance Sheet Data
MNE$_{f,t}$	Dummy equal to 1 if firm receives inward FDI	NBB Survey on Foreign Direct Investment
FDI in region$_{f,r,t-1}$	Number of countries in region r in which firm f has foreign affiliates at $t-1$	NBB Survey on Foreign Direct Investment
Exports in region$_{f,r,t-1}$	Number of countries in region r in which firm f exported at $t-1$	NBB Foreign Trade Data
FDI by other firms$_{i,t-1,k}$	Number of Belgian firms of sector k (2 digit NACE) with affiliates in country i at $t-1$	NBB Survey on Foreign Direct Investment
Exports by other firms$_{i,t-1,k}$	Number of Belgian firms of sector k (2 digit NACE) exporting to country i at $t-1$	NBB Foreign Trade Data
GDP$_{i,t}$	Gross Domestic Product of country i in year t in constant 2000 US$ (billions)	WDI
GDP per capita$_{i,t}$	GDP per capita of country i in year t in constant 2000 US$ (thousands)	WDI
BIT$_{i,t}$	Dummy equal to 1 if country i has a bilateral investment treaty with Belgium at t	ICSID database
Distance$_i$	Distance in km between Bruxelles and the capital of country i (thousands)	CEPII
Common Language$_i$	Dummy equal to 1 if French is an official language of country i	CEPII
Colony$_i$	Dummy equal to 1 if country i has ever been a Belgian colony	CEPII
Regulation$_{i,t}$	Index of regulatory quality of country i	Kaufmann *et al.* (2009)
Variance Regulation$_i$	Variance of Regulation$_{i,t}$ (1997-2008)	Kaufmann *et al.* (2009)
Differentiated$_k$	Share of subsectors classified as differentiated (3 digit NACE)	Rauch (1999)
Tariff$_{i,t,k}$	Average tariff applied by country i in sector k (4 digit NACE) at $t-1$, $t-2$, $t-3$	WITS

Table A-2: Population of firms by export and FDI status

Year	Total Firms	World		Outside SM	
	in Belgium	Exporting	With FDI	Exporting	With FDI
1997	8,527	5,054	308	2,903	82
1998	8,763	4,561	346	2,876	98
1999	8,839	4,566	347	2,852	103
2000	8,787	4,557	360	2,851	121
2001	8,667	4,575	435	2,824	146
2002	8,499	4,520	446	2,814	143
2003	8,416	4,511	451	2,786	148
2004	8,350	4,454	464	2,828	150
2005	8,345	4,392	388	2,824	143
2006	8,369	3,958	391	2,807	154
2007	8,372	3,869	379	2,862	157
2008	7,168	3,477	323	2,543	137

Notes: Only firms with more than 5 employees included. Single Market defined as EU27 plus Iceland, Liechtenstein, Norway, and Switzerland.

Table A-3: Export and FDI relationships

Year	Export Relationships		FDI Relationships	
	World	Outside SM	World	Outside SM
1997	55,572	23,420	807	173
1998	55,822	23,119	974	214
1999	56,025	22,923	1,004	230
2000	57,330	23,748	1,127	283
2001	58,603	24,135	1,335	330
2002	58,693	24,172	1,383	332
2003	58,846	24,025	1,369	336
2004	60,046	24,517	1,324	334
2005	60,774	25,194	1,222	322
2006	57,155	25,366	1,312	390
2007	57,156	25,591	1,296	387
2008	53,408	24,764	1,147	349

As in Table A-2.

Table A-4: Top 10 destinations

Export				FDI			
World		Outside SM		World		Outside SM	
5.57%	Netherlands	5.71%	USA	16.71%	France	18.70%	USA
5.42%	France	3.13%	Turkey	9.19%	Germany	7.83%	China
4.89%	Germany	3.04%	Japan	9.14%	Netherlands	5.52%	Turkey
3.83%	UK	2.81%	Canada	7.34%	UK	5.03%	Singapore
2.92%	Spain	2.78%	Israel	5.03%	Italy	4.67%	Brazil
2.90%	Switzerland	2.68%	Australia	4.85%	USA	4.40%	Australia
2.88%	Italy	2.66%	Russia	4.30%	Spain	4.29%	Japan
2.77%	Luxembourg	2.49%	South Africa	3.08%	Luxembourg	4.08%	Canada
2.41%	USA	2.46%	China	3.02%	Poland	3.56%	India
2.18%	Denmark	2.38%	Hong Kong	2.32%	Czech Republic	3.48%	Hong Kong

Notes: Percentages based on year-firm-destination observations over the 1997-2008 period.

Table A-5: Top 10 manufacturing sectors

Export				FDI			
World		Outside SM		World		Outside SM	
13.68%	15	12.84%	15	14.89%	24	18.27%	24
12.56%	28	10.79%	17	13.82%	15	12.20%	15
8.83%	17	10.59%	28	9.33%	29	12.07%	29
8.43%	29	10.27%	29	8.72%	28	7.59%	25
7.55%	24	9.81%	24	7.40%	25	6.89%	17
6.42%	22	7.06%	25	6.71%	26	6.70%	26
6.27%	25	5.27%	36	5.69%	17	5.50%	27
6.03%	36	4.47%	22	4.56%	27	4.17%	28
5.08%	26	3.84%	31	4.19%	22	3.92%	31
3.36%	18	3.65%	18	3.65%	21	3.73%	34

NACE classification:
15: Manufacture of food products and beverages
16: Manufacture of tobacco products
17: Manufacture of textiles
18: Manufacture of wearing apparel
19: Tanning and dressing of leather
20: Manufacture of wood and of products of wood and cork
21: Manufacture of pulp, paper and paper products
22: Publishing, printing and reproduction of recorded media
23: Manufacture of coke, refined petroleum products and nuclear fuel
24: Manufacture of chemicals and chemical products
25: Manufacture of rubber and plastic products
26: Manufacture of other non-metallic mineral products
27: Manufacture of basic metals
28: Manufacture of fabricated metal products
29: Manufacture of machinery and equipment
30: Manufacture of office machinery and computers
31: Manufacture of electrical machinery and apparatus
32: Manufacture of radio, television and communication equipment and apparatus
33: Manufacture of medical, precision and optical instruments, watches and clocks
34: Manufacture of motor vehicles, trailers and semi-trailers
35: Manufacture of other transport equipment
36: Manufacture of furniture

Notes: As in Table A-4.

Table A-6: Firm size and productivity

	Mean	St. dev.	Min	Max
Domestic firms				
Employment	40	73	5	1,542
Productivity	0.50	0.91	0.004	43.86
Exporting firms				
Employment	142	446	5	10,283
Productivity	0.60	0.49	0.006	12.77
Firms with FDI				
Employment	970	1613	12	8,559
Productivity	0.77	0.33	0.201	1.67

Notes: Domestic defined as those not exporting to any market in our sample in 1997; Exporting firms defined as those exporting to at least one market in our sample in 1997. Firms with FDI defined as those with foreign affiliates in at least one markets in our sample in 1997. Employment measured in units. Productivity defined as ratio of value added to employment (divided by 100).

Table A-7: FDI entry

Year	World	Outside SM	Outside SM with exports in previous 4 years
1997	160	40	20
1998	94	22	18
1999	98	31	24
2000	170	60	36
2001	223	58	46
2002	111	27	24
2003	90	25	24
2004	99	32	26
2005	74	31	21
2006	84	40	29
2007	72	26	17
2008	74	31	26
Total	1,349	423	311 (73.5%)

Notes: As in Table A-2.

Table A-8: Death rate of new exporters following export entry in year t

Time	$t+1$	$t+2$	$t+3$	$t+4$
Surviving firms	13,428	8,748	6,547	5,262
Death rate	58.32	34.85	25.16	19.63

Notes: Statistics based on 32,214 export entries, excluding firms with very small initial exports (1st percentile of export values in year t).

Figure A-1: Firm-level exports in new destinations, by entry cohort